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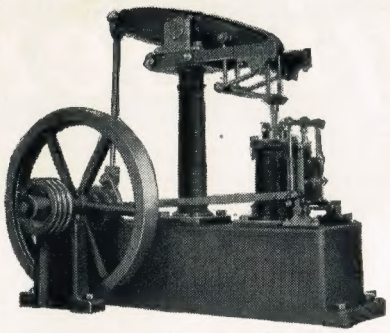
Field gun, 1917

ONE SHILLING

10 JANUARY 1957 VOL 116 NO 2903



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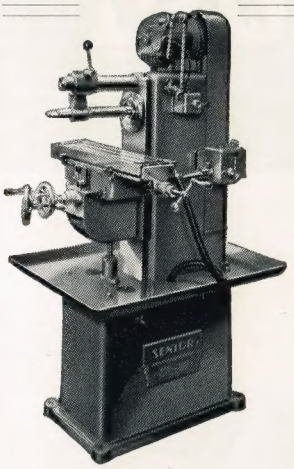

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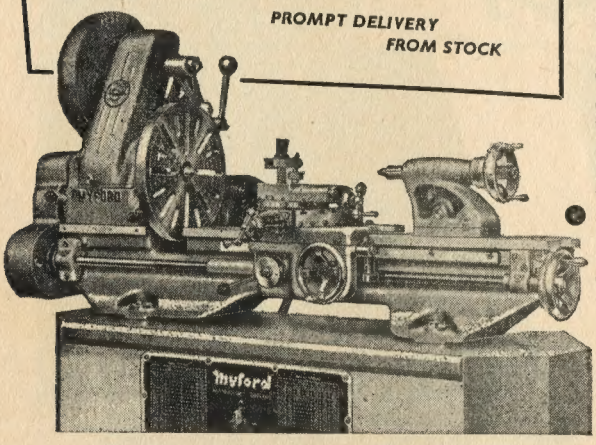

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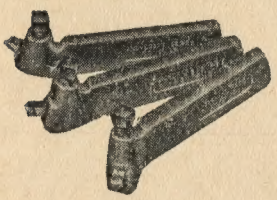

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All correspondence should be addressed to the Editor, Model Engineer, 19-20 Noel Street, London, W 1

SMOKE RINGS

A WEEKLY COMMENTARY BY VULCAN

AFTER the striking success of the Sailing Ship Race from Torbay to Lisbon last July, there was a general feeling that it should be repeated. This is now being arranged and the Sail Training Association has approached the French and Spanish governments for their support for a race from Brest to Teneriffe in the Canary Islands to be held in 1958.

So far eight countries are proposing to send ships to compete. It is expected that Britain will again be represented by the three-masted staysail schooner *Creole* and at least four other vessels. *Creole* is the largest fore-and-aft rigged yacht in the world. Built by Camper and Nicholson at Cowes, she is at present under Greek ownership.

A number of square-rigged ships are again expected to take part. The ships will all be manned by cadets from various schools.

High-speed marine engines

A NEW tendency in the propulsion of ocean-going ships has appeared recently in the 6,400 ton diesel-electric ship *Tinnum*, built in Germany for Zerssen and Co.

Her sister ship M.S. *Rantum* was fitted with a Fiat Borsig engine of 3,600 b.h.p. installed amidships, but the *Tinnum* has five 12 cylinder V-type Daimler Benz engines, each of 885 b.h.p., placed aft and running at 1,300 r.p.m. These drive 600 kW generators which provide the current for driving the single propeller.

The five high-speed engines weigh less than a single slow-speed engine of the same power output, and the arrangement gives the *Tinnum* 10 per cent. more cargo space than that of her sister ship. The design is based on experiments with high speed Daimler Benz engines which were installed in the company's steamer *Hörnum* in 1954, and which have proved very satisfactory.

This could quite well be the beginning of a new era in the propulsion of medium-sized cargo vessels. One advantage of the arrangement is that in the case of engine failure the ship is not put out of action, as is the case where the power unit is one large engine.

Mallard meanders

IT was a winter's dusk and I was waiting for a Cambridge train on Hitchin station. When the locomotive drew in, I was at once struck by her size and evident power. Peering forward, I read the nameplate. The light was rather dim and I stepped closer for a more careful view.

There was no mistake: the locomotive that stood on Hitchin station in the Saturday evening dusk was the magnificent *Mallard*, whose speed of 126 m.p.h. has given her a place in railway history.

From Hitchin to Cambridge we stopped at the little country stations while the local passengers—tired

SMOKE RINGS . . .

housewives loaded with their shopping, lively young people on their Saturday-night adventures—stepped off and on with no idea, I am sure, that the train was drawn by the fastest and most famous locomotive on rails.

At our terminus I asked the driver how the record-breaking *Mallard* came to be pulling a slow train through the quiet villages of Cambridgeshire. Having explained that she was being given a run-in after an overhaul and was to be taken North the following day, he nodded towards the laurel wreath on her side. "And," he said with a pride that I found moving, "she's still the fastest engine in the world!"

A youthful veteran

AT the time of writing these notes, British Railways, Western Region, possess two of the former 73 engines of the old four-cylinder 4-6-0 Star class. These three survivors were scheduled for scrapping in 1954 but they are still at work on main-line trains, and at least one of them is in very good form.

This is No 4056, *Princess Margaret*, stationed at Bristol, and Mr O. S. Nock, writing in *The Journal of the Stephenson Locomotive Society*, describes three recent trips on the footplate of this 42-year-old engine.

On the first trip the old engine had a gross load of 325 tons on the 8.30 a.m. from Bristol to London, a train that stops at Bath and Chippenham and is allowed 101 min. for the 94 mile nonstop run from the latter place to London. There was a signal check to 30 m.p.h. through Swindon; another, less severe, at Foxhall Junction (Didcot) and a long p.w. check to 10 m.p.h. at Pangbourne.

In spite of all these the engine achieved an actual time of 96½ min.; but after allowing for the checks the net time was no more than 88½ min. The speeds attained were 75 m.p.h. before Didcot; the same held unbrokenly from milepost 28 until near Slough, and an *average* of 73.3 over the 21.9 miles from Twyford to Southall.

Trips two and three

The second trip was on the 6.45 a.m. mail train from Bristol to Newton Abbot; this time the load was 340 tons gross and the following times were made between stops: Bristol to Weston 19.1 miles in 26 min.; Weston to Bridgwater, 15.2 miles in 20¾ min., and Bridgwater to Taunton, 11½ miles in 15½ min. Here, a fresh crew took over and there began what might have been a fine climb of the Whiteball bank, with speed as high as 52 m.p.h. at Wellington.

But at Beam Bridge a signal check, right on the 1-in-80 bank, brought the speed down to 20 m.p.h.; all the same, the engine, without a trace of slipping, recovered to 26 m.p.h. as she entered Whiteball tunnel.

The arrival at Exeter would have been on time but for a signal stop outside. On the final 20.2 miles from Exeter to Newton a permanent way check to 15 m.p.h. at Exminster caused the very tight 26 min. schedule to be exceeded by 2½ min.

The third trip was in the reverse direction with a train of 375 tons on the 11.34 a.m. from Newton to Bristol. Time was kept throughout, but the trip included what Mr Nock describes as "one of the fastest climbs to Whiteball that I have ever recorded in ordinary service"—23½ min. for the 19.9 miles, with speeds of 63 m.p.h. at Cullompton and 44½ m.p.h. at the top.

J.N.M. adds that on 25 October 1955 *Princess Margaret* worked the 325 ton 11.45 a.m. two-hour express from Bristol to London and kept time with it.

Cover picture

A model 18-pounder Mk 1 field gun (1917) made by S. A. Walter, of Wembley Park. Mr Walter, a versatile model engineer of considerable ability, has won several awards for his skill. This gun won a bronze medal at the 1955 M.E. exhibition.

Vintage motorcycles

FOR more than 20 years Harold V. Eddy, a Penzance reader of MODEL ENGINEER, has been riding four-cylinder motorcycles. He owns two Henderson machines, one of them the last of its type to be made by the Henderson factory.

In addition he has collected a good deal of lore, including "a fairly complete history of the Henderson from 1912 to 1931," and scores of Henderson pictures. Many Indian motorcycles are also featured in his album, together with the Spanish Patria-4, the Cleveland-4, the Ace-4 and the Vauxhall-4. One can read about the Vauxhall-4 as well as studying it in a very good whole-plate.

"Some of the models," writes this enthusiast at England's western end, "have very unusual features. For example, the Henderson KJ has cast aluminium petrol tanks without any seams. They are quite thick and the physical features are just as unusual in that they have a 35 per cent. elongation without fracture and can be literally battered out of shape without breaking." The remainder of the specification, he says, is equally remarkable.

I am sure that many Fans of the Four would be delighted to spend an hour or so with Mr Eddy and his collection.

Looking along the body repair shop at the new Aldenham depot recently opened by London Transport

A modified Perkins boiler

KYRLE W. WILLANS discusses the merits of the Perkins design and gives some suggestions for modernising the unit

THE ACCOUNT, in a contemporary, of an attractive steam car built in the country prompts me to suggest that enthusiasts might do well to follow the designs of Mr Loftus Perkins rather than those of Mr Derr, should they consider building a steam car.

There is not the slightest doubt that the Derr boiler steams well but its satisfactory construction presupposes considerable welding ability, a very large number of welds, and poor facilities for internal inspection. The Perkins system, on the other hand, while reducing the amount of welding materially, provides, in the variation proposed in this article, means of internal cleaning and inspection.

The illustration of the Perkins boiler fitted in the *Anthracite*, the small yacht that did the trip across the Atlantic both ways in 1880 without bunkering en route, shows the method of construction adopted by the inventor.

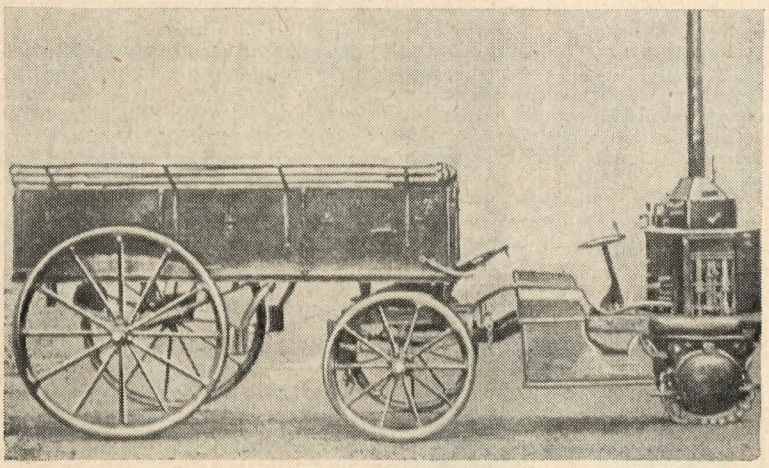
The horizontal tubes forming the heating surface above the fire were 3 in. o.d., 2¼ in. i.d. and 4 ft 7 in. long. There were 14 sections each consisting of a vertical gridiron of 10 tubes high. The firebox was surrounded by rectangular rings of tubing of similar size with a space left for the firedoor aperture. It is not proposed, as inspection of the sketch will show, to perpetuate the bent rings.

The short pieces of tube connecting the straight tubes and also the rings were $1\frac{5}{16}$ in. external dia. and $\frac{7}{8}$ in. internal dia. screwed one end right-hand and the other left-hand fine thread. Holes in the 3 in. tubes were screwed left and right and the short tubes screwed into place and caulked round.

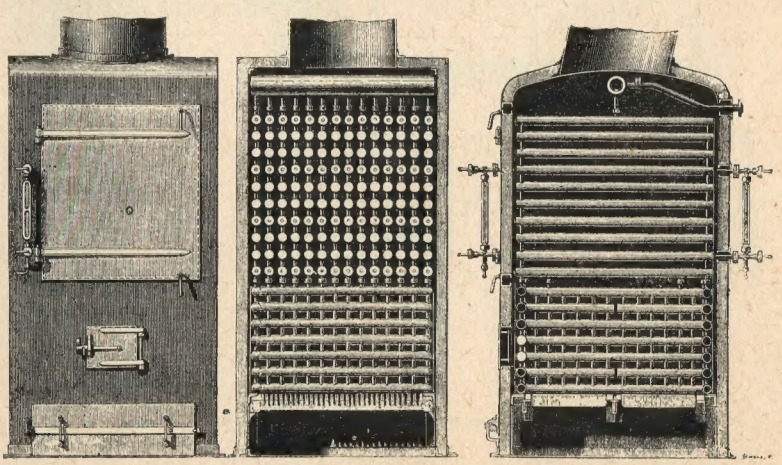
The threading of the holes in the 3 in. tubes necessitated their walls being at least $\frac{3}{8}$ in. thick. No facilities were provided for internal inspection of the tubes, the ends being fire-welded in place.

It is beyond question that the boiler, as built to Mr Loftus Perkins's designs, worked and worked well. I have in my possession the log book of *Anthracite* which, fitted with Perkins machinery, made the double passage of the Atlantic in 1880. The average working pressure was 350 p.s.i. The book was given me by Mr Loftus Perkins, son of the famous inventor.

It is somewhat puzzling why this steam generator has received so little attention, particularly from steam-car enthusiasts especially as Mr Perkins constructed and ran a steam road vehicle, the carriage portion, judged from a picture, being an army corps general service wagon and the



Above: Perkins steam road carriage of 1870



Right: Boilers of the small steam yacht ANTHRACITE

Perkins boiler

machinery being mounted on wheels fitted seemingly with solid rubber tyres protected by steel plates connected by chains.

This type of tyre, as some readers at any rate will know, was invented by Thompson and fitted to his three-wheel road steamers. The illustration I possess of the Perkins vehicle is not very clear and it may well be that the driving wheel was a single one. I think that the steering was effected on the lines of the Bond Minicar, by rotating the entire power unit, wheel and all.

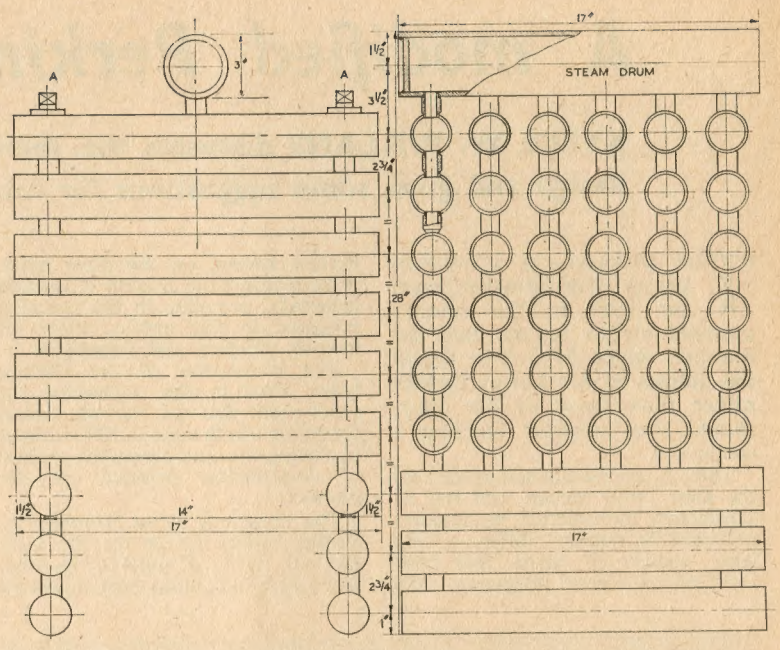
Obviously the generator, as built by Mr Perkins, would not be accepted for boiler insurance purposes as the diameter of the horizontal elements would bring them into the category of pressure vessels and since both ends of the element were closed by plugs welded in an internal inspection could not be carried out.

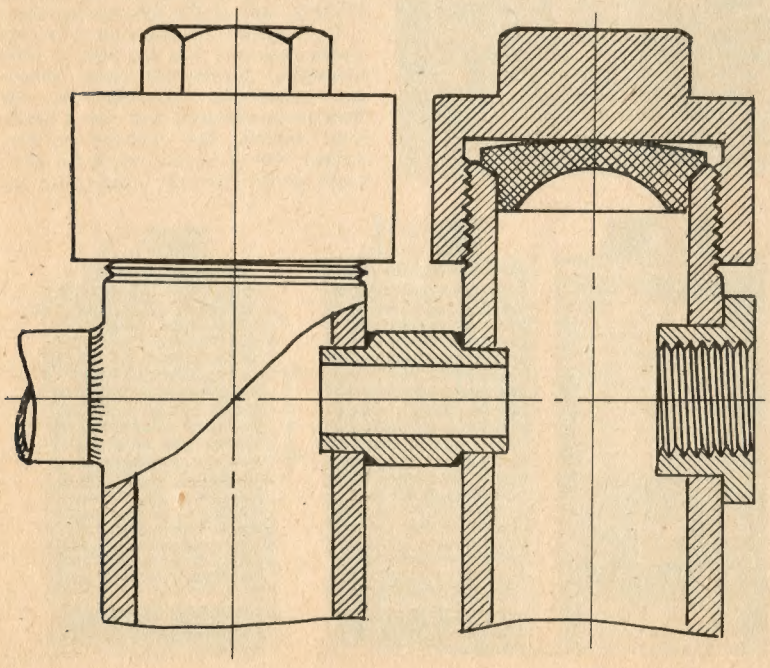
Again, in these days of welding, it would be unnecessary to use tubes thick enough to carry a thread long enough in itself to ensure a steam tight joint with caulking.

If the insurance engineers insisted that some additional support to a weld was required the holes into which the connectors entered could be tapped, the connectors screwed in, and the joint made by welding.

It seems certain that the boiler would be accepted for insurance under motor-car regulations if internal inspection of the horizontal tubes could be made at the normal inspections. There is no reason why one end of the element should not be closed by a plug welded in permanently.

I would be inclined to screw a plug into the other end after modifying the tube as shown in the sketch. This arrangement would ensure that withdrawal of the plug enabled the interior of the tube to be readily examined with a torch. The possibility of the plug becoming frozen in place must not be forgotten but in these days of portable drills the removal of a frozen-in plug would not be an insuperable obstacle. I feel, however, that one of the pipe jointing compounds on the

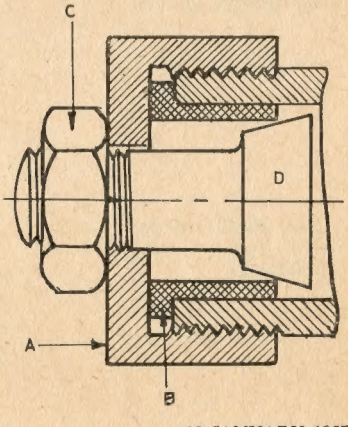




Above: *The Perkins steam-drum boiler*

Below: *Alternative method of making joints at ends of elements. Cap A is screwed to the end of the element and holds aluminium sleeve B. Tightening nut C causes plug D to expand*

Left: *Sectional views of connector*



market would ensure against the need to " drill out."

It will be seen from the suggested form of the revised version of the Perkins boiler that the bent tubes waterwalling the firebox are done away with. In place of these two sides of the firebox are waterwalled. Of the remaining sides one would carry the oil burner and the other could best be filled in with a slab of firebrick.

It will be noted that the connectors right through the boiler are in line and so, by removing plugs in the upper elements of each row, a rod can be passed down through each element, the rod being provided with a rough form of reamer at the end to scrape out any deposit that might form. The interior of the horizontal elements could be readily scaled by removing the plugs.

The water-gauge and automatic feed water regulator would be mounted on a water column connected at the top to the steam drum and at the lower end to one of the elements forming the sides of the firebox. The position of the superheater, if any, would depend on the use to which the boiler was put. I favour a superheater in the firebox.

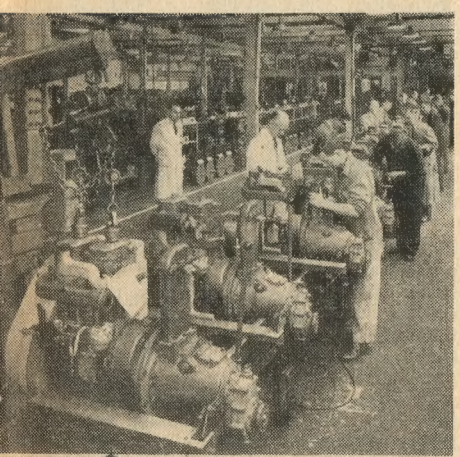
In so far as the method of carrying the boiler is concerned it is obvious that the easier the boiler can be removed from the car, if used in a steam car, the better from the point of view of acceptability by the insurance companies. It should be possible to lift the entire boiler out in one piece after disconnecting feed water system and steam-pipes, and after removal of the boiler from the car to remove the casing also in one piece.

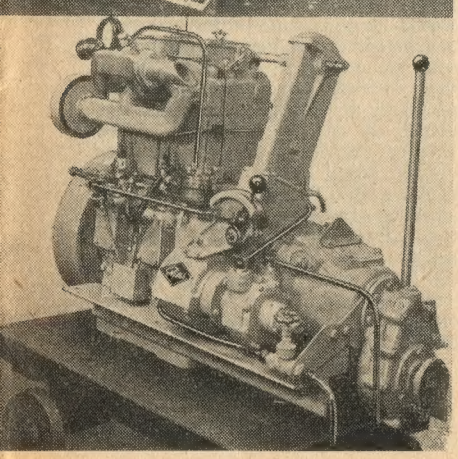
With regard to size, much depends on requirements. Taking as a comparison the 25 sq. ft steam generator recently described in connection with the new steam car built, a Perkins type generator would require 36 elements each 2 in. o.d. and 16 in. long. These could be built into a space about 18 in. × 18 in. × 27 in. The vertical dimension is based on the connectors between each row of elements being 1 in. long. Obviously a reduction of $\frac{1}{4}$ in. per connector would reduce the overall height of the element block to 25 in.

In arriving at these overall dimensions the waterwalls to the firebox have, from the point of view of heating surface, been disregarded and the additional height caused by the steam drum has been omitted as it would be contained in the smokebox. ▣

PETTER — Past and present

A brief review of the history of a famous engine manufacturer





FOR HALF A CENTURY or more, the name of Petter has been known in every sea-going community of the world—from Scandinavia to the Far East.

The modern development of the Petter company began as far back as 1895 when three brothers decided to explore the possibilities of the internal combustion engine. In that year the brothers built a car; and in 1910 the first two-stroke diesel engine to be manufactured in Britain was a Petter product.

Moving in 1947 from Loughborough to Staines, the company opened its post-war production in a factory designed on the most modern lines. The old foundry at Yeovil, where the three brothers experimented with faith in themselves and the future, seems a world away from the powered assembly tracks, the floor conveyor, the special duty machines for each component part, and all the other devices which belong to a progressive engineering works in 1956.

With all this, Petters have lost none of their original pioneering drive. Some British firms, having earned for themselves a dignified fame, are content to rest rather pompously on their reputation until the cold wind of competition forces them to stir. At best, their movement is towards improved techniques. But go to Petter's factory on the Thames and you will find there not only first-class new machines but also first-class new ideas.

In recent months, for instance, Petters have produced a complete range of air-cooled and water-cooled marine diesel engines designed for heavy duty in deep-sea, inshore and river craft. The air-cooled engines are known as AVA1 and AVA2 and the water-cooled as AV1 and AV2.

With the air-cooled engines, troubles arising from dirty or freezing water are eliminated. There is also a saving of about a tenth in the overall weight. The engines cost less than the water-cooled type and the absence of skin fittings, water pump and pipe fittings makes them easy and economical to instal.

Both types have the virtues to be expected of anything made by Petters. I was impressed, when I first saw them, by their handsome, compact appearance; and later, at a demonstration on the Thames, by a performance which thoroughly justified their good looks.

Petter engines, through their use in ship's lifeboats, have helped to save innumerable lives, and the astonishing ease and speed with which the air-cooled engine can be started and run while the lifeboat is still in the davits leaves no doubt that the AVA in particular will be welcomed by all who go down to the sea in ships.
—J.M. ▣

A SIMPLE STEAM ENGINE—8

Notes on boilers for stationary engines

By EDGAR T. WESTBURY

Continued from 27 December 1956, pages 908—910

SINCE the commencement of my latest series of articles on the Theseus engine many readers have asked for information on the design and construction of suitable boilers for this and other engines—mostly of the stationary type—for testing and demonstration purposes.

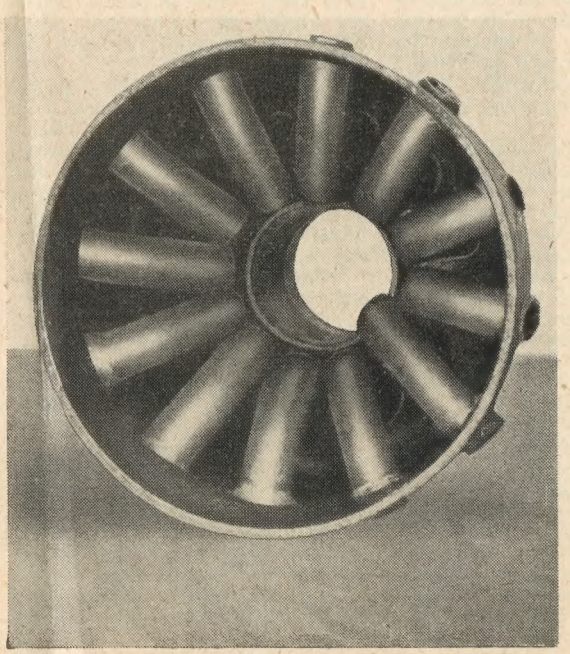
Although the ultimate object in all cases is the same—namely, the generation of steam in sufficient quantity and pressure to drive the engines—the individual detail requirements of querists vary widely. Some of them wish to make boilers which are fairly accurate scale replicas of those used in full size practice, while others are concerned more with quick steam raising and rapid evaporation; yet again, methods of firing and use of various fuels are often important considerations.

To take the matter of "scale model" boilers first, it is quite a simple matter to model the type of boiler which would be used in a relatively small stationary installation of some 50 or 60 years ago, when horizontal reciprocating engines of a type comparable with those which I have described (such as the Unicorn, Tangye and Theseus) were fairly popular.

The most common boilers in those days were those of the Cornish and Lancashire types, both of which were of the horizontal cylindrical types, with internal furnaces, the main difference between them being that the former were usually made with a single furnace and the latter with two and, occasionally, more. In a small boiler the single furnace would be preferable, not only for simplicity in construction, but also to enable a single burner to be used for firing.

If, however, the main idea is fidelity in "scale" appearance, it should be noted that both the above types of boilers cannot be considered complete in this respect unless they are equipped with their external return flues and tall chimney, which are almost invariably of brickwork.

Top, right: Brigadier Richards demonstrating the vertical test boiler at the M.E. Exhibition



Left: Problem picture . . . a worm's eye view of a firebox showing the water tubes

Generally speaking, most installations of this type have very little of the boiler visible except the top and the furnace front—almost the only time one sees the entire cylindrical boiler shell nowadays is when it is on the scrap heap!

A boiler of the Trident internal-flue type, described in the issue of MODEL ENGINEER dated 13 May 1954, would be quite suitable for a stationary installation, though designed primarily for marine work. Two sizes of these boilers have been described, and fully detailed prints of the larger (Mark I) can be obtained. The smaller (Mark II) would probably supply ample steam for an engine such as the Theseus, under normal working conditions, but as it is more than likely that additions will be made to the plant, such as a feed (donkey) pump, or that the boiler will be called upon for testing other engines, a larger boiler is a good investment.

VERTICAL BOILERS

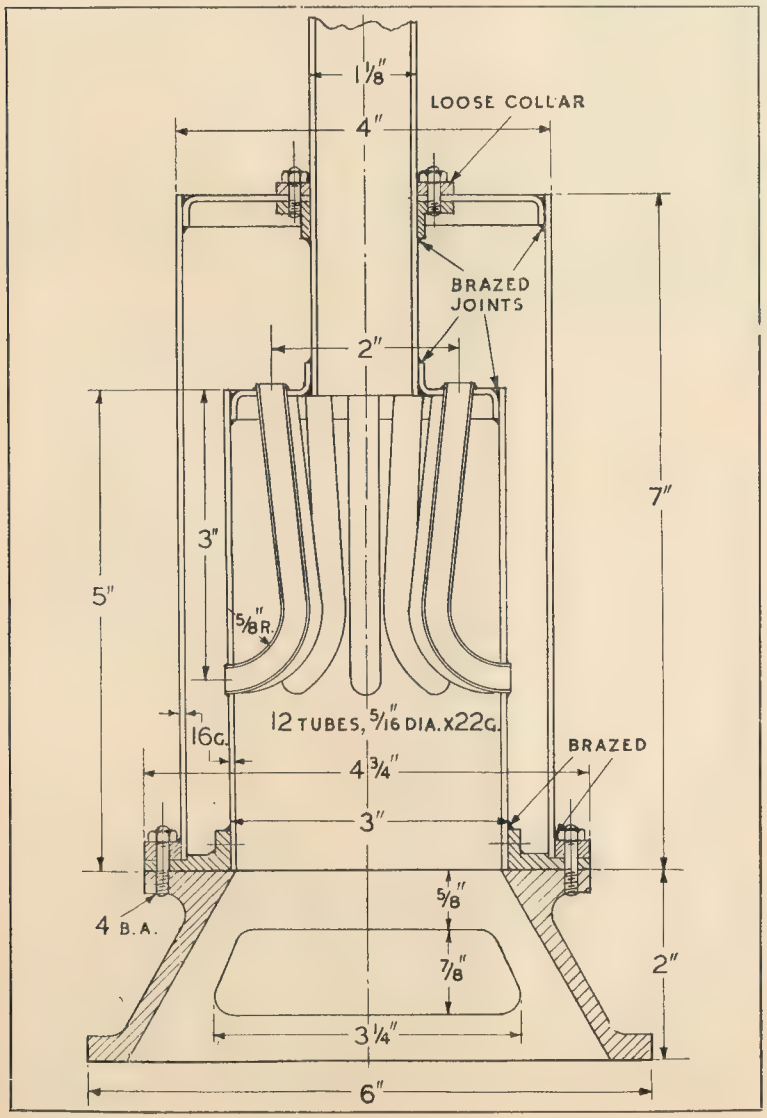
Vertical boilers have not been very widely used in full-size stationary

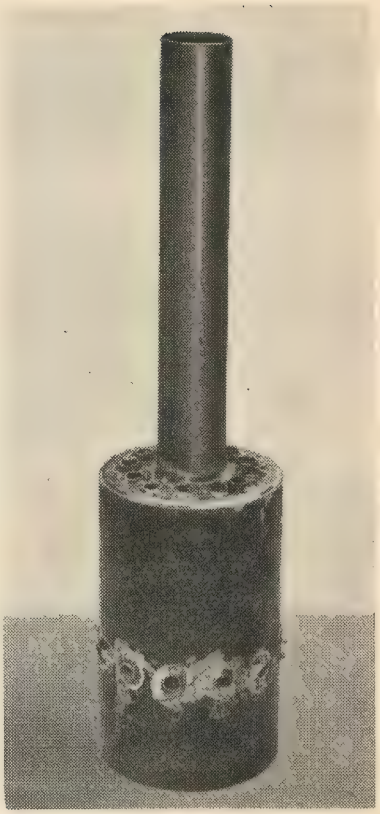
plants, except possibly such boilers as the Cochran or "haystack" boilers, which are not easy to model; their internal design is not well adapted to construction on a small scale. But portable installations—such as contractor's plant, dockside cranes, etc.—up to about 10 or 12 nominal horse power have been, and still are, steamed by relatively simple vertical boilers of the type that used to be called "coffee pots." One practical advantage of the vertical boiler in small sizes is that natural draught is more certain and effective than in horizontal types, whatever method of firing is employed.

The small vertical test boiler which I described and illustrated in the issue of MODEL ENGINEER dated 29 April 1954 has been built and employed with success by several readers, and I have no hesitation in recommending it to those constructors of Theseus or similar stationary engines who are content with any type of boiler which will produce the desired results. As some of them may not have a copy of this issue available, I am reproducing the drawing, which gives all the essential particulars and dimensions, though it is capable of being made in varying sizes and with detail modifications to suit requirements or preferences.

As mentioned in the original article the design embodies methods of construction which enable all the internal parts, including brazing or silver

General arrangement of the vertical boiler



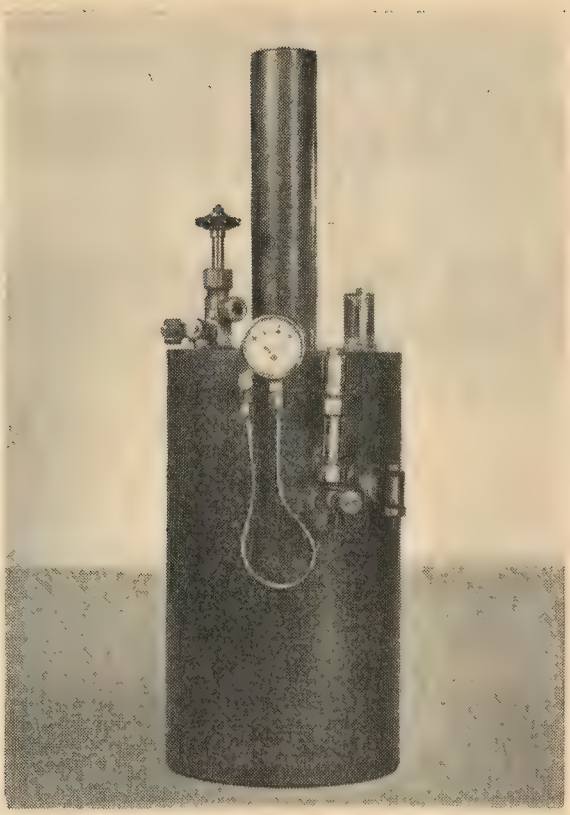


The inner components of the boiler made by Brigadier Richards after brazing the water tubes and other joints

soldering of joints to be completed and, if desired, tested, before fitting the external shell, which may be either permanently brazed or made capable of detachment at any time. The heating surface afforded by the internal water tubes, in conjunction with their shape and disposition, which promotes easy convection flow, makes the boiler a quick and efficient steamer; if, however, the work of fitting these tubes is considered difficult and the user is satisfied with lower efficiency, they could be omitted and the boiler thus converted to a simple centre-flue type. Alternatively, a few straight water tubes may be fitted obliquely across the firebox, as is rather more usual in this type of boiler.

This design, with some modification in the construction, has been adopted for test purposes by Brigadier Richards who is well known to visitors to the M.E. Exhibition as one of the principal demonstrators of brazing and boiler construction. He preferred, however, to complete the entire fabrication by

STEAM ENGINE continued



The completed vertical boiler, with essential fittings, less base ring for liquid fuel burner

brazing, rather than making the external shell detachable and, in view of his experience in boiler-making, this involved no difficulties.

While this particular boiler was under construction some criticism was encountered regarding its margin of strength, and the suggestion was made that it would be necessary to fit stays between the inner and outer shells to avoid risk of collapse in the former case. As the boiler was not intended for extremely high pressure, however, I did not agree with this, especially as the stiffness of the inner member is increased to some extent by the fitting of the water tubes. The matter could quite easily be settled by the hydraulic test—which, I would emphasise, should never be neglected by constructors of any type of boiler, large or small.

On completion of the boiler, Brigadier Richards fitted it up for testing with a hand pump, but was rather dismayed to find, after plying the pump handle vigorously, that the pointer of the pressure gauge remained stolidly against the stop pin, though no escape of water was perceptible. When the force required to work the pump became excessive, however, he began to think that there must be "a coloured gentleman in the lumber stack." Ultimately he found that he had forgotten to drill the hole through the union connection to the gauge!

I recount this experience, not merely for "amusement only," but because it proves that the boiler *must* have been subjected to a pressure far in excess of the designed test-pressure without turning a hair. For normal routine tests, it is not necessary or desirable to apply pressure beyond 50 per cent. above normal working, but the fact that a boiler will withstand much higher pressure at least proves that its margin of safety is fully adequate.

Observance of the "50 per cent. plus" rule in periodic tests of not less than annual frequency will keep a check on any possible deterioration in the course of either working or storage—the latter, if due precautions are not taken, may be more destructive than hard work. Boilers, if laid up for any length of time, should either be emptied and completely dried out by gentle heat, or filled right up to the top with clean water to exclude all air (marine engineers have a term for it: "WW" or double-working level).

In view of the high and increasing cost of copper these days, many model engineers are considering the possibility of using other metals. I have already expressed my opinion that steel boilers are perfectly satisfactory, and experience has shown that the most serious objection to them, liability to corrosion, can be almost or completely avoided by these measures. The idea of using aluminium alloys for boilers is not beyond practical possibility nowadays in view of modern developments in so-called aluminium "brazing" methods, but I have not yet seen it tried.

HEAT CONSERVATION

Comparatively few model stationary boilers are lagged—possibly because constructors do not like to cover up and conceal their painstaking work—yet it is more important from the practical point of view to insulate them against heat radiation losses than it is with large boilers because the ratio of surface area of metal to internal volume increases as the size is reduced. Polishing the outside of a copper or brass boiler does reduce radiation slightly, but blackening it, as is often done, increases heat loss.

The external shell of either horizontal or vertical boilers can be effectively lagged with a layer of loose felt, or similar open-texture fabric, about ¼ in. thick, held in place by "cleading" of metal or wood, the latter being very effective in appearance if well carried out. This applies only, however, to "water-walled" surfaces; a "dry" firebox or furnace back must be lagged with asbestos, in the form of loose matting or millboard. The former is most effective as an insulator, though the latter, if damped and moulded to shape, may be more convenient for application to uneven surfaces and needs little to hold it in place when used in this way.

● *To be continued.*

GUIDE TO LATHEWORK

Written by Edgar T. Westbury, an acknowledged authority in this field, *The M.E. Lathe Manual* is one of the most comprehensive books on the modern lathe. Model engineers and others will find how to get the best service and produce the most accurate work from comparatively simple machines. Price 12s. 6d. from Percival Marshall, 19, Noel Street, W.1. Postage 1s. (U.S.A. and Canada $3.00).

By GEOMETER

Second operation set-ups

A SOUND lathe-work principle is to machine as much as possible of a component at a single chucking in order to preserve alignment between faces and concentricity on diameters and to save time in resetting.

Many chucks do not hold really truly, particularly after a period of use, and there are components whose slenderness or fragility renders their rechucking a problem. Often, of course, a second set-up is inevitable and consideration must then be given to ensuring truth, avoiding distortion, and performing the work with the minimum of trouble.

A diameter, bore, or face on material gripped and machined in the chuck is obviously true until the material is moved, so that any such feature employed for alignment will result in a component being true on a second set-up.

Stub mandrels, as at *A*, machined from material held in the chuck, provide for the true setting up of bushes, sleeves, small wheels and pulleys, previously finished in the bore either by accurate boring in the lathe or drilling and reaming. Friction drive is sufficient for light cuts, and a mandrel can be turned with a slight taper, or a taper produced by a Swiss file and/or abrasive cloth. Pushing a component on by hand is sufficient and, in some cases, a smear of oil is advisable to prevent seizing. If the component is tight a clamp or protected-jaw pliers may be needed for removal.

Using a nut and washer, a component can be gripped on a mandrel; and when overhang is considerable support can be given from the tailstock. Mandrels may also be run between centres—but, naturally, more time is needed for making them. For ordinary stub mandrels scraps and off-cuts of most common materials can be used—mild steel, brass, aluminium alloy; and they can be given a reference dot mark to No 1 jaw for rechucking when necessary—or set up in an independent chuck.

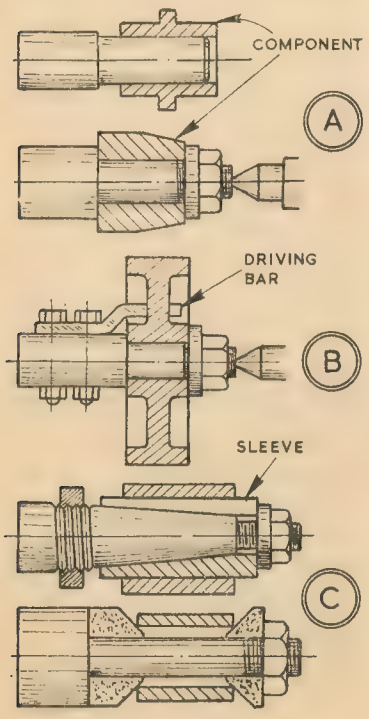
A problem may arise when a large diameter must be turned with the component on a mandrel, since a friction grip, or even a mounting with a nut on the end of the mandrel, will not ensure a slip-free drive. In the case of wheels or pulleys with spokes or holes, a solution is to employ a driving bar bolted to the mandrel and shaped and "set" as required to pass between spokes or through a hole. The mandrel should be partly finished, the bar fitted, then removed while the locating diameter and face are machined. Again support from the tailstock may be necessary in use, as at *B*.

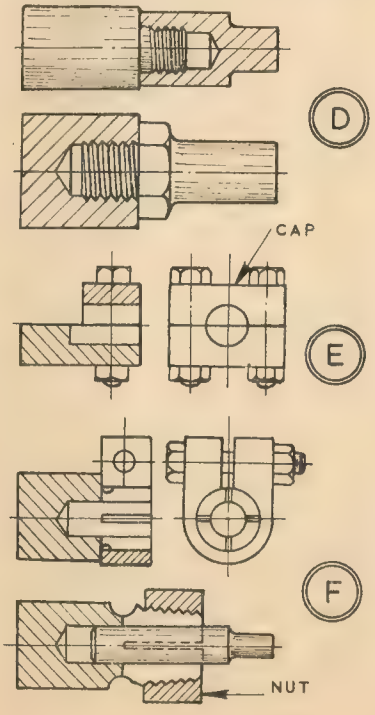
On more elaborate mandrels to run between centres an expanding sleeve or opposed cones may be used in the bores of components, as at *C*—the cone type somewhat wanting in accuracy. For the expanding sleeve the mandrel is tapered and the sleeve slit lengthwise to be displaced by a nut. A second nut at the large end is advisable when the mandrel taper is slight—to free the sleeve by screwing back against it.

Provided with threads externally or internally stub mandrels in the chuck afford means of setting up screwed components, as at *D*, for operations on the outer ends—turning, facing, threading, etc. To ensure truth, threads on the mandrels should be screwcut or cut with dies or taps from the tailstock.

Spindle-type components or those with shanks for location can be set up in various sorts of clamping or contracting mandrels or collets. A simple and effective type can be made from flat stock, as at *E*, by bolting on a cap and setting in an independent chuck for drilling and boring—the cap then being eased on the joint face for a grip to be obtained on the shank of the component.

Collets to contract and hold components can be as at *F*. For the clamping type the stub mandrel is bored, turned, and a small undercut made at the shoulder. Without removing from the chuck the end is slit lengthwise with a fine saw. For closing, a clamp as shown is better than a collar with a screw. The type with a nut can have a taper thread by not running the die on fully, while the nut can be undersize from not passing the tap right through. ▣





The author—and EMMA

THE STEAM LAUNCH

E M M A

Instal a 22 ft launch ? C. E. PARSONS did—with nothing more than a small workshop at his disposal

IN 1938 I was fortunate in obtaining a 20 i.h.p. compound surface condensing steam launch engine built by Thos Savery of Birmingham—probably about the year 1912. Plans were drawn up to fit this in a boat mated to a Lune Valley paraffin-fired boiler. The war, however, intervened and the plant was stored. But only the engine survived.

After hostilities I was unable to proceed with an actual boat installation though some progress was made with the making of some of the ancillary items in the hope that one day I might find myself more suitably placed. This, in fact, came to pass for in 1953 I moved to South Devon and found myself living within a few minutes of one of the pleasant estuaries that are a feature of the western coastline.

The main problem was a suitable boiler and so drawings were prepared for a water-tube boiler that could be constructed within the limits of my small workshop equipment. About this time I was offered a new second-hand Merryweather water-tube vertical boiler, and I purchased it. I was aware that this was not a suitable partner for the Savery engine since the working pressure was only 120 lb. and the Savery was designed for 250 lb. of moderated superheat.

However, I was proposing only to drive a 22 ft 6 in. launch, and I considered that the lower pressure would suffice especially as the steaming capacity of the Merryweather boiler appeared on paper to be sufficient, being quoted at over 300 lb. per hour at 212 deg. F. with forced draught. Oil burning was considered but turned down—principally on account of the cost of the liquid fuel and also that coal firing can be rather enjoyable and need not be too dirty providing certain care in the design of bunkers and ash receptacles is observed. (My main objection to coal burning is the slightly longer time required to raise steam, but as this can be done in about 20 minutes this is not unreasonable.)

Some alterations to the boiler mountings were done and all outlet valves were centralised on to one gunmetal manifold casting, and are: safety-valve, main stop-valve, stop valves for the forced-draught fan engine, the Weir-type donkey pump, the blower and the bilge ejector. Three check valves were fitted for the main engine, donkey and hand-feed pumps and Klinger-type plate glass water-gauge substituted for the glass-tube type. The shell of the boiler is heavily lagged with glass fibre wool covered with brass-bound teak slats and brass cleading on the boiler top.

A five-spear headed superheater element was made up from about 40 ft of $\frac{1}{2}$ in. o.d. × 16 S.W.G. seamless steel tube and these elements are expanded into steel headers. The superheater can be by-passed should any of the elements fail and the engine worked on saturated steam. The boiler is mounted on a $\frac{1}{4}$ in. thick sheet steel baseplate on the underside of which is bolted an air and watertight copper ash pan fitted with an airtight door for ash removal. About one inch of water is kept in the ash pan for quenching the ashes. The funnel is of galvanised sheet steel fitted with a liner and mounted with a brass capping and skirt.

Air for combustion is forced into the ash pan by means of an 8 in. dia. centrifugal fan driven by a small double-acting steam engine of $1\frac{1}{4}$ in. bore × $1\frac{3}{4}$ in. stroke mounted on the fan casing. This engine started life as a small air compressor. Two ball races have been fitted to the crankshaft and another on the outboard end of the fan shaft; the original piston is retained as a crosshead and a piston-valve steam cylinder of gunmetal was bolted on top of the compressor cylinder. The piston, valve and rods are of stainless steel and the valve is operated by an eccentric cam driving a spring-loaded hardened steel tappet. Thus the valve is moved only in one direction by the cam and is returned by the spring like an i.c. engine valve.

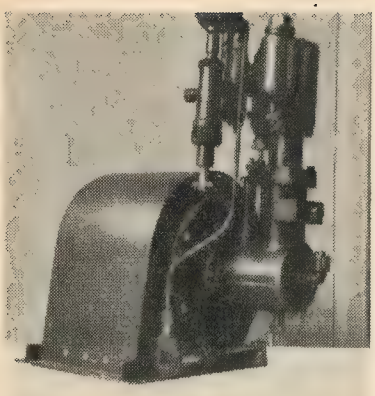
For moderate speeds this gear seems to have much in its favour, as it is simple and has no pins or bushes to wear slack and rattle. Saturated steam to the engine is supplied through a reducing valve and no internal lubricant is used. The exhaust passes into a feed heater and thence to the condenser.

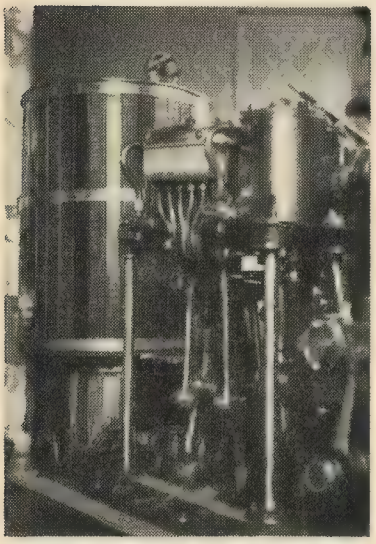
The donkey pump is of the Weir type and made entirely of gunmetal and stainless steel; the shuttle valve is fitted with floating cylinder ends to compensate wear on the valve face. The water end is double acting and is fitted with wheel valves controlling suctions from the main feed tanks and the condenser and deliveries to the boiler and the main feed tanks. The steam cylinder is $1\frac{3}{4}$ in. bore, the water cylinder $1\frac{1}{4}$ in. bore × 2 in. stroke. The exhaust passes to the condenser via the feed heater.

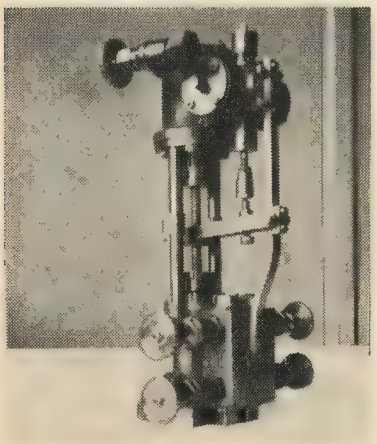
The main engine is a compound with cylinder sizes of 3 in. and 6 in. × $3\frac{1}{2}$ in. stroke fitted with piston valves to both h.p. and l.p. cylinders, the valves being operated by a form of Joy gear in which the curved slide and die blocks are replaced by a radial motion somewhat on the lines of the Bremme or Marshall gears. The valves, being behind the cylinders, result in a very neat short engine. The vacuum and feed pumps are worm driven and run at one third of the engine crankshaft speed.

Mechanical lubricator

The Savery engines were about the peak of steam launch engine design and the quality of workmanship was excellent. Despite the age of the engine it would compare well with modern practice, as all pins are hardened and ground to very fine limits; the piston valves float on spherical ball joints and all glands are well designed with a large depth







Top: Forced draught fan and engine

Centre: Front of the Savery engine with the boiler behind

Bottom: Weir type double-acting donkey pump 1¾ in. × 1¼ in. × 2 in. stroke

to diameter ratio, with the result that gland leakage does not exist.

The engine is well balanced for a two-crank compound and has been run light at 1,000 r.p.m. without bolting down. Integral with the crankshaft are three thrust collars mated to adjustable white metalled shoes, the whole thrust running in an oil bath. Driven from the feed-pump crankhead is a small mechanical lubricator which supplies oil to an indirect type of colloidal graphite lubricator, thus avoiding the serious boiler troubles that arise from internal lubrication by oil in a condensing plant.

The colloidal graphite used is a proprietary brand and is mixed with water. At the time of writing the engine has been opened up for an end-of-season examination and the bores of the cylinders and valves appear to be in a highly satisfactory condition, having acquired a very high glaze.

Owing to anticipated boiler-pressure fluctuations, which were considered inevitable with a forced, hand-fired rapid steaming boiler of small water capacity, a special type of engine throttle-valve was designed and built to control, within limits, engine r.p.m. fluctuations caused by variations in boiler pressure. This is a combined reducing and throttling valve. The body is a gunmetal casting fitted with a stainless steel valve and valve seat. The valve is balanced by a flexible metallic bellows and equilibrium is upset by applying a variable spring-loaded pressure to the valve spindle by means of the hand-wheel control. With practice it has been found easy to maintain a full head of steam of 110-120 lb., and about 70 lb. on the engine will drive the boat at a comfortable cruising speed of seven-eight knots, while a maximum of just about nine knots can be obtained at full-throttle opening.

The engine exhausts via a copper pipe 1¾ in. dia. to the aft end of the keel condenser which is a 6 ft length of flattened 2 in. dia. copper tube fitted with faired-cast end pieces for passing through the skin of the boat. The engine vacuum pump and the donkey pump have connections to the forward end of the condenser. The engine is totally enclosed in a teak casing, with only the throttle- and reversing-lever controls protruding. About 28 in. of vacuum are obtained on the l.p. exhaust. All exhausts and drains are led to the condenser and, as all rod glands are packed with s.e.a. rings, leakage is practically non-existent. Thus make-up feed is reduced to almost the minimum and amounts to little more than a few pints for an afternoon's run, the loss of water being mainly attributed to the use of the whistle, the bilge ejector, the occasional use of the blower and safety-valve blow offs.

The hull is 22 ft 6 in. long × 6 ft beam and about 2 ft draught aft and is carvel-built of teak planking on oak timbers, floors, keel, etc., with all joinery work of teak. There are four copper tanks for reserve fresh feed-water of approximately 30 gallons capacity and a coal bunker under the centre thwart of some 2 cwt capacity. The rudder and stock are of bronze and steering is by both tiller and wheel, the latter being adjacent to the engine and boiler controls. The propeller shaft of 1½ in. manganese bronze runs in a stern tube with a white-metal inboard bearing and gland and a ferrobestos outboard bearing. The shaft is supported immediately in front of the propeller by a bracket and runs in a cutless rubber bearing.

Little vibration and noise

The propeller is of manganese bronze, 18 in. in diameter, right-handed and three bladed of 26 in. pitch, developing a surface area of 140 sq. in. and a d.a. ratio of 0.55. With 100 lb. of steam on the h.p. valve and 27 in. of vacuum on the l.p. exhaust, the engine turns at about 600 r.p.m. with a surprising lack of vibration and noise. In fact I am continually being asked by members of the public why the boat is so quiet when under way. Fuel consumption works out at about 1 lb. per mile at six-seven knots, but increases to nearly 3 lb. when everything is pushed hard so that the running costs compare favourably with a paraffin engine or semi-diesel.

I am always prepared to recognise the modern i.c. marine engine as a respected and reliable unit, but for sheer pleasure I doubt whether there is anything to touch the old steam launch—and certainly I receive nothing but praise from passengers on the smooth running of my plant, the ease of reversing and the wonderful slow-running qualities combined with that little reserve of power that somehow is always there with a steam engine. ▣

MAKE YOUR OWN CLOCK

You can equip every room in your house with accurate and inexpensive timepieces if you follow the instructions in *Electric Clocks and How to Make Them* by F. Hope-Jones. It gives details for building the Synchronome master clock, and it also contains a number of full working instructions in line with current practice. Price 10s. 6d., postage 8d., from Percival Marshall, 19, Noel Street, London, W.1 (U.S.A. and Canada $2.50).

A variable fine feed for a lathe

J. W. PATTISON gives details of a device that avoids the obvious shortcomings

THIS MECHANISM was designed to overcome some of the shortcomings of the more usual methods of driving the leadscrew so as to provide a very fine feed. Made up as a permanent attachment it can be brought into action instantly whenever the necessity arises.

Its construction graduated from my earliest attempt, wherein a single-thread worm, meshed with a change wheel on the leadscrew. This device had the merit of extreme simplicity and is worth describing.

It was simply a length of shafting with a worm at one end and a pulley at the other. This ran in bearings made from a length of flat bar bent to an elongated U-shape and screwed to the bench at the exact height to allow the worm to mesh with the largest change wheel when the latter was mounted on the end of the leadscrew.

This shaft was of such a length that it could slide axially in its bearings and all that was necessary to bring the device into operation was to push the shaft forward until the worm meshed with the wheel. When driven, the thrust of the worm itself held it in engagement.

To bring it out of action one simply pulled the shaft and the worm was free. Crude, but very simple and it worked surprisingly well. However, to switch from screwcutting to slow feed invariably meant some wheel changing, as the largest wheel was always required on the leadscrew to contact the worm.

The other end

As things were getting rather cramped at the headstock end, the next move was to try the other end of the leadscrew, this being much more accessible and out of the way of normal screwcutting. Here the assembly was pivoted on a stud, so that the worm could be moved in and out of mesh with changewheels of varying diameter. A three-speed pulley was also added to further increase the range of speeds.

There remained, however, several minor faults to be rectified before satisfactory working could be achieved. The worm, for instance, did not mesh smoothly with the straight-cut teeth of the lathe wheels and again the screwcutting train was always one short of its quota. Even at this stage, although the device could only be classed as a temporary "rig-up" it did turn out quite a lot of work, but gradually, due to minor faults, I found myself using it less and less.

This state of affairs existed until I took delivery of a new lathe and the ambition to make further improvements began to assert itself. In any case, a new lathe was thought to be as good a reason as any to design something new.

Having a fairly lucid idea of what would be required to build an attachment such as I had in mind, a casual rummage in my government surplus department revealed an excellent balanced handwheel, a cast baseplate which was rather too long although otherwise perfect and last but by no means least a steel worm and bronze wheel.

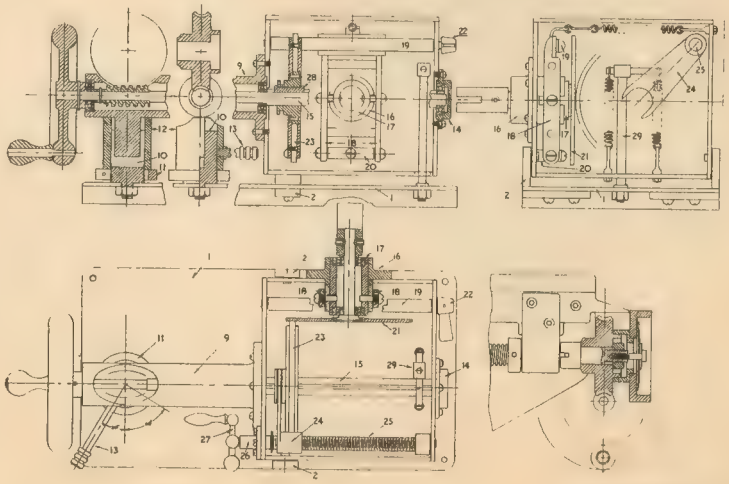
Now as these items were at hand and were just what I required they were pressed into service, hence no details as to their construction are given. A handwheel could be cast and turned up, likewise a worm and wheel, but it is to be hoped that would-be constructors will be able to acquire these items as I did. As to the cast baseplate, this would have been better made from a sheet of $\frac{1}{8}$ in. steel, such as described, but unfortunately a piece of the required size was not in my possession at the time I constructed the machine.

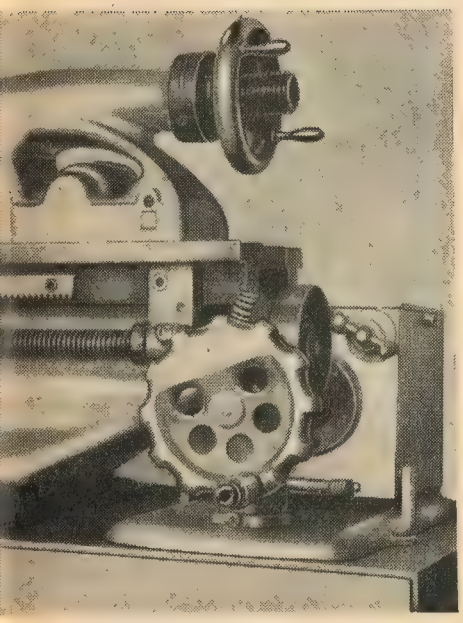
Being of the opinion that it is cheaper to make mistakes on paper, the drawing board was set up and a start made on the general layout. Here it was decided to use friction drive for the variable gear, as many years ago I drove a veteran G.W.K. car with that form of drive and I knew just how it performed. In any case, friction drive had proved its worth in the model world with Mr Westbury's excellent i.c. locomotive, and the work it would be called upon to do in this instance would be very light compared with that of a model locomotive.

This design was apparently a wise one as subsequently it was found that the attachment did everything it was designed to do and in a very easy and practical manner. Built as a unit it can be screwed to the bench alongside the lathe and removed at any time without interfering with the latter.

As it does not employ any of the lathe changewheels, these may be set up and left to carry out their legitimate job of screwcutting. It amply covers all ranges of slow feeds and these may be varied at any time, whether the lathe is running or not,

The general arrangement of the attachment





The gearbox in position on the lathe

simply by turning a small handle. A flick of a lever changes it from power to handfeed and used in this latter capacity the driving handle, being in front of the lathe, falls conveniently to hand just in the right position for fast or slow turning.

This handwheel, geared to the leadscrew through the 11 to 1 worm and wheel, makes handfeeding a pleasure. Should the lathe be required for screwcutting, another lever operating a cam lowers the worm out of mesh and the leadscrew is free. The simplicity of these movements is comparable to flicking over an electric light switch.

There are other features which can be credited to friction drive, such as the ease of construction, silence in working and the advantage of being directly reversible, thus the tool may be made to travel in either direction. Due to the layout of the attachment the end of the leadscrew is left conveniently for fitting a micrometer dial and this latter, frictionally secured, may be instantly set to zero. It is graduated around one edge in thousandths and the other in sixty-fourths.

As the attachment was designed to fit an ML7, the primary drive was taken off the countershaft, but this was simply a matter of convenience as all I had to do was to remove the collar on the end of the countershaft and substitute a similar one with a V-groove cut in it to take a $\frac{1}{8}$ in. dia. round belt. In adapting the attachment to any other lathe it may be found more convenient to take the drive from the lathe mandrel, which is the more conventional method of driving.

With a variable gear there is little to choose between either method when it comes to practical working so long as one remembers what difference is taking place. Briefly what happens is this: assuming the friction drive set to some definite gear reduction, then with the primary drive taken from the mandrel the t.p.i., or cuts per inch, will be fixed and the time taken for the saddle to traverse one inch will vary with each change of mandrel speed. Alternatively, with a constant-speed primary drive, be it taken from the countershaft, the lathe motor or even an independent source, the time taken to move the saddle one inch will be fixed and it is the t.p.i. which will then vary with every change of mandrel speed.

One advantage of having a variable speed attachment at one's disposal is that an adequate range, either in time taken or t.p.i., is covered, so it remains only a matter of choice whether the primary drive comes from the mandrel or otherwise.

CONSTRUCTION

The parts are numbered on the general arrangement drawing for easy reference with the corresponding detail drawings. The handwheel and worm gearing are not numbered for reasons previously mentioned. The former should be as near as possible a duplicate of the existing handwheel, having a crank throw of about $1\frac{1}{2}$ in. to $1\frac{3}{4}$ in. for convenient working.

The worm is of the three-start type and the wheel has 32 teeth. Pitch centres are approximately $1\frac{3}{8}$ in. apart. This has been found to be an ideal gear reduction and should be adhered to as closely as possible. The pitch centres, of course, may be anything within reason.

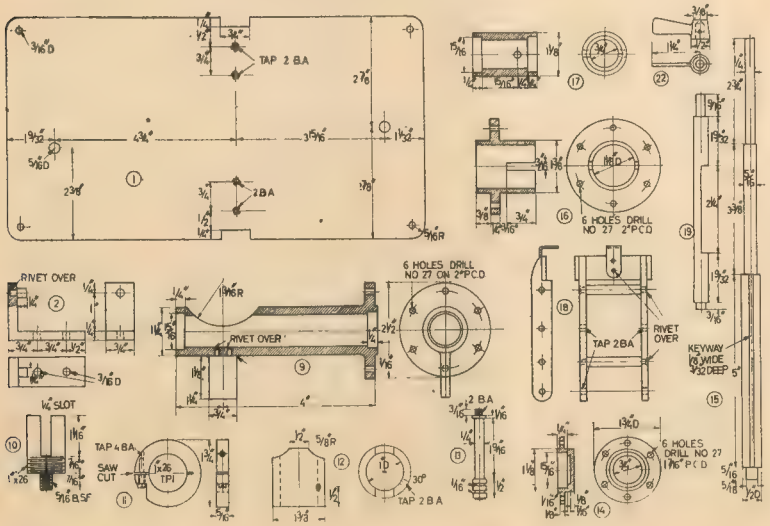
A start can be made with the baseplate, detail 1, which may be of steel plate $\frac{1}{8}$ in. thick or over. Unless flanged around its edges, however, it will be necessary to pack it up with spacers slipped over the holding down bolts, or a slip of hardwood or metal around the edges would serve the same purpose, namely, to provide clearance for the bolt heads projecting underneath.

Mark off and drill the holes as shown, then fit the trunnion bearings (2) which support the box. These are simply $\frac{3}{4}$ in. slices cut from 2 in. angle bar, the pins being turned down and riveted in place. They come flush with the edge of the baseplate, suitable slots being cut to accommodate them. Fasten to the baseplate with a couple of 2 B.A. screws in each.

Before drilling the hole for the cam bearing check the distance from the centre of the leadscrew to the back of the lathe bed. If the attachment is to be used other than on an ML7, or if a worm and wheel of slightly different dimensions is used, the gearbox may foul the back of the lathe when in position. The dimensions shown allow for a clearance of $\frac{1}{8}$ in. when used, as on the original. Any difference would only mean altering the length of the shaft and extended front bearing.

The gearbox is made up from six pieces of $\frac{1}{8}$ in. mild-steel plate held together at the corners with angle bar. If preferred, it would be an excellent

Miscellaneous gearbox components



Variable fine feed for a lathe . . .

idea to make the lid of the box with Perspex, or similar material, so that the position of the friction wheel may be readily observed. Alternatively a pointer could be attached to the operating fork which, if brought outside the box, could travel along a scale marked to indicate gear ratios.

Future refinement

Such a refinement has not as yet been fitted to the present mechanism, but something of the sort will be added in the near future. Probably it will take the form of a Perspex lid with a scale marked thereon, having the indicating pointer travelling along underneath. The corner pieces which hold the box together are again simply made by cutting $\frac{5}{16}$ in. slices from a length of 2 in. angle bar and secured with 6 B.A. c'sunk screws, except for those at the bottom of the box which may be riveted.

Make the top angle pieces fit flush where the cover will rest. Allow the base to be recessed flush with the bottom of the box. One screw at each corner will be sufficient to hold the cover; screws likewise are more convenient for holding the box sides as assembly is facilitated and one or more of the box sides can be removed for machining as required.

The front, rear and drive sideplates will each in turn have to be set up in the lathe for boring and recessing where necessary. These recesses need only be a full $\frac{1}{16}$ in. deep or just sufficient to locate the housing of the bearings accurately. Before altering the setting, it will be easier if you possess a drilling spindle to run through each of the six holes spaced radially around the bore, but do not tap them until later. The other holes may be accounted for either in the lathe or drilling machine.

For setting out the centres of the various holes it is advisable to make up the box first and complete the job on some sort of a marking-off table, rather than set out each plate individually. When completed the box should be tried on its rocker bearings, where it should fit neatly without any shake and be spaced about $\frac{1}{4}$ in. above the baseplate.

The long extended front bearing (9) can now be made, either from solid material or, if a suitable piece of tubing is available, a flange can be brazed on and then turned and bored. Note that all the ball-bearings used in this machine were from government surplus and measured $\frac{15}{16}$ in. outside diameter and $\frac{1}{4}$ in. thick with a bore of $\frac{5}{16}$ in. Anything near these sizes can be used provided the shafts and housings are cut to suit.

It will be as well to mention that the handwheel I had available had a solid boss. This was drilled and reamed $\frac{1}{4}$ in. to suit the shaft and an extended sleeve left on to fit the $\frac{5}{16}$ in. ball-bearing. As it is unlikely that an unbored wheel will be at hand, a bush can be made and turned to suit.

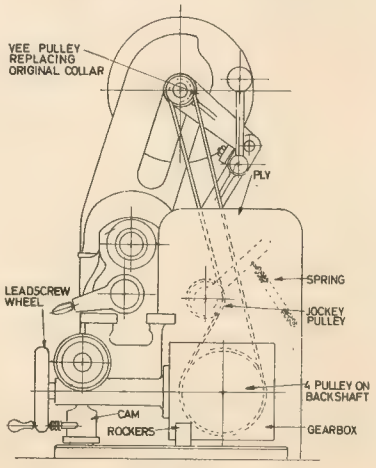
Having bored the housings for the bearings, the next job will be to cut the opening for the worm-wheel. If a suitable cutter is at hand, this can be milled out, or failing this the bulk can be hacksawn and finished with a file. Once this opening has been made, drill a couple of holes through the remaining side of the tube into which will be riveted the tongued piece, which hangs down underneath and acts as a steady for the handwheel end of this extended bearing.

File up the tongue from $\frac{3}{4}$ in. $\times$ $\frac{1}{4}$ in. steel bar, rivet into place through the holes just drilled and finally braze. Fit the flange accurately to the frontplate of the gearbox, making sure that the tongued piece hangs vertically underneath. Clamp in position then drill through the six holes. Enlarge the holes in the flange clearing size and tap the corresponding ones in the box 4 B.A.

For fine adjustment

The pillar (10) locates both cam and tongued piece. This may be got out of a short length of steel or brass bar, turned down to pass through the baseplate and screwed to take a $\frac{5}{16}$ in. nut, the remainder being turned to 1 in. dia. and screwcut in the lathe

Showing how belt drive from countershaft works the device



26 t.p.i. for $\frac{1}{2}$ in. of its length and finally parted off $1\frac{1}{2}$ in. long.

It may then be bolted to a scrap of $\frac{1}{4}$ in. plate, the latter clamped to the milling machine table and slotted with a $\frac{1}{4}$ in. thick cutter, or simply drilled, hacksawn and filed. The thread on the outside takes a split nut (11) which may be turned from steel bar, bored and screwed internally 26 t.p.i. and finally parted off $\frac{5}{16}$ in. thick.

It is then split as shown in the drawing, a segment cut out to locate the locking screw head, then cross drilled and tapped to take a 4 B.A. screw. It is used to obtain a fine adjustment when meshing the worm and wheel, after having fixed the attachment at a suitable height from the bench and bolted it down.

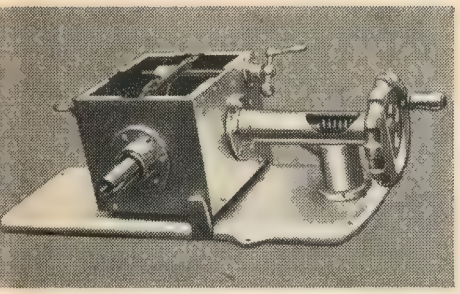
The cam (12) is merely a piece of steel bar bored out a sliding fit over its bearing support and with part of a semi-circle filed or milled on its top edge so that the worm will be either raised or lowered by a quarter revolution of the cam.

For operating the cam, the handle (13) is turned from steel rod to the sizes shown, knurled at the business end if preferred and the other end screwed 2 B.A. for a bare $\frac{3}{16}$ in. It is screwed into the cam until tight and if any of the thread protrudes this can be cleaned off with a file.

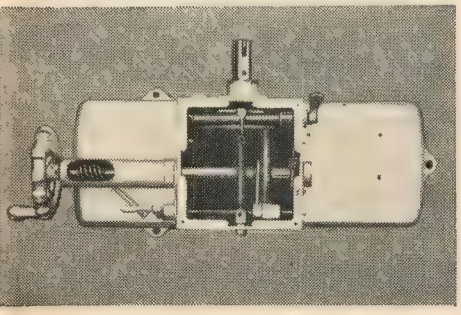
Note the angle of the screwed hole in relation to the cam. This is arranged for convenient working otherwise when the cam is in the raised position the operating lever could get tucked away behind the handwheel. The cam, of course, works against the pressure of two springs in the gearbox, its action being positive when the worm is engaged and spring-held when out of engagement.

Having got the extended front bearing fitted up, the rear bearing next claims attention. This is of easy construction compared with the front one. It may be of brass or steel parted off a bar. Turn the register a bare $\frac{1}{16}$ in. deep, so that it will locate itself neatly in the recess already cut in the rear plate of the box. Clamp in place and drill for the six fixing screws. As before, make those in the bearing clearing size and tap those in the box 4 B.A.

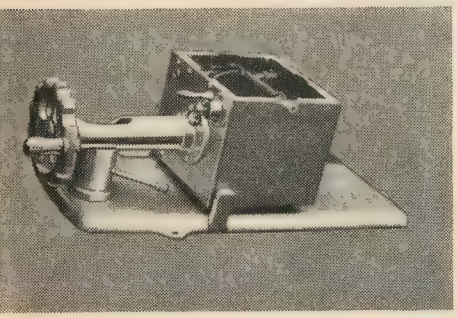
The shaft (15) is rather an awkward job to turn between centres unless a steady is used. If the hollow mandrel will take it, a length of polished bar the right size may be set to run truly in the chuck and with the back centre in use the slender portion can be turned quite easily, using a sharp tool and fine cuts. When sizing the shaft for the middle ball-bearing reduce the rest of that portion of the shaft slightly so that the bearing will

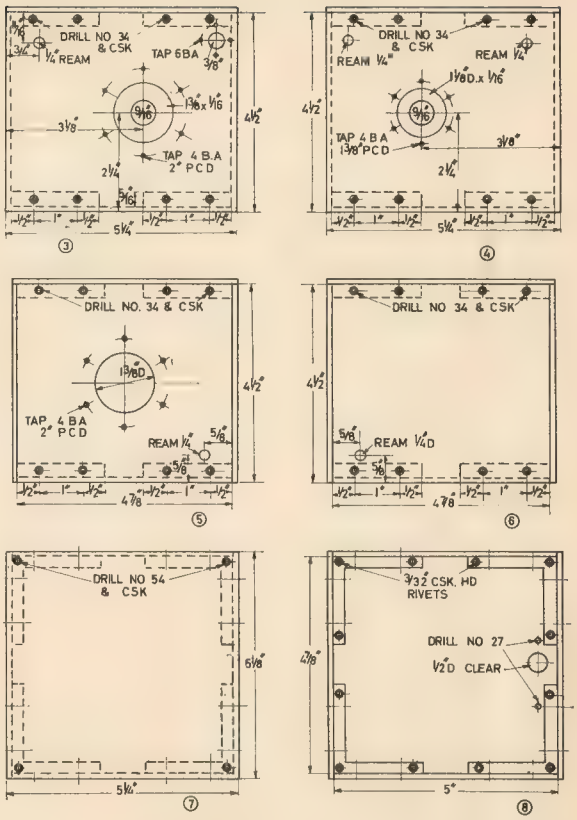


Right: Details and dimensions of the fabricated gear case



Left: Three views of the variable-speed gearbox





slide on easily until it reaches its fixed position.

Reverse the shaft in the chuck and turn down the opposite end to fit the rear ball-bearing. I cut the key-way in the milling machine by laying it in one of the table's T-slots, with a cramp to hold it in position. The cutter was $\frac{1}{8}$ in. wide and the depth of cut 3/32 in. deep. A similar set up would do for a shaping machine. It can, however, be easily cut in the lathe with a woodruff type cutter or an end-mill. Again it can be put between centres and planed out with a well raked ripping tool laid on its side at centre height with a travelling steady behind the work.

Coming now to the primary drive side of the box, the outer bearing shell is turned, bored and a slot cut to clear the operating fingers of the clutch mechanism. It is secured in a similar manner to the other two bearings with six 4 B.A. screws. The inner sliding member is turned and bored to take the ball-races, taking care to get a fine finish on the outside and a neat sliding fit in the outer housing. This sliding arrangement allows for the power to be applied by engaging the friction disc and its driving wheel. To complete this item, a transverse hole $\frac{3}{16}$ in. dia. is drilled $\frac{1}{2}$ in. from the inner end.

The clutch arms (18) may be cut from $\frac{1}{2}$ in. $\times$ $\frac{3}{16}$ in. mild steel and are held apart by $\frac{1}{4}$ in. dia. rods, the ends of which are turned down and riveted into the arms. The upper end of these arms is spanned by a plate against which the cam bears. This plate is brazed or riveted to the sideplates and carries a projecting eye on its centre which anchors the tension spring. It is bent at right angles and riveted to the top-plate, the other end having a hole to accommodate the spring.

If the spring is not of the right length an extension link can be bent up from steel wire and inserted to make up the length; such a link is shown in the drawing. The other end of the spring is anchored to the box by a suitable eye filed or milled from $\frac{1}{4}$ in. round bar, drilled to take the spring and turned down at the other end and either screwed 6 or 4 B.A. to take a nut or left plain and riveted in place.

Detail 19 shows the cam, which may be got out of a length of $\frac{3}{8}$ in. round-steel rod, turned down at each end to run in unbushed holes in the box. The middle of this rod is then filed flat for a distance of $2\frac{1}{4}$ in. The depth of this flat should allow for a movement of about $\frac{1}{8}$ in. of the clutch arms. This, plus a bare $\frac{1}{16}$ in. clearance, will mean filing it about halfway through, but any adjustment can be made later.

A lever to operate this rod will be necessary. The one shown looks like half a winged nut and was purposely made like this for convenience. It snaps over like an electric light switch, due to the spring acting against the cam. It is easily made by turning to a cone shape and brazing in the wing, a tapered pin holding it on the rod.

Shaft and disc

Supporting the lower end of the clutch arms, the bearing is a plain rectangular block (20) held to the box

Variable fine feed for a lathe . . .

by a single screw and drilled at each end to receive the shouldered screws on which the arms themselves are pivoted.

At a position about halfway up the arms, two round-headed screws are used to act as fingers and engage the sliding bearing. They are driven in tightly, the remaining portion of the threads having been turned off. Their duty is very light, but they could with advantage be case hardened. They must clear the slot in the outer housing and be an easy fit in the sliding member.

It is very important to have the driving disc running true and to achieve this the shaft was turned from a piece of bar the size of the flange which was left thereon. The disc was cut from $\frac{1}{8}$ in. steel plate, turned and recessed to take this flange left on the shaft and secured with six 3/32 in. countersunk rivets. The whole assembly was then mounted in the lathe for cleaning up and a light cut taken across both faces of the disc leaving it about 3/32 in. thick.

A slight depression will have to be made in the centre of the disc to clear the driven disc when on dead centre. This need only measure $\frac{3}{8}$ in. dia. across the face of the disc and have a depth of $\frac{1}{16}$ in. If the countershaft method of driving is adopted, as on the original, some form of universal joint will be necessary to allow for the up and down movement of the box. A backshaft from the countershaft drive makes the angle of movement very small and a simple cross-pinned coupling was used. It can be turned, bored and slotted as shown and held securely to the shaft with two Allen screws. It is shown in detail 22.

For the friction wheel (23) the boss should be turned first. Bore the centre hole a sliding fit for the shaft, cut the groove for the operating fork and mark off and drill the holes for the countersunk rivets. Plane out the keyway with a parting tool laid flat on its side in the toolpost, or failing that cut out with a file.

The discs are trepanned out of a 3/32 in. steel plate, sandwiched with a sheet of plywood and screwed to the faceplate. Bore the centre hole first a neat fit for the boss and if some form of dividing head and drilling spindle is available the 12 holes around the edge may be drilled before finally cutting out the disc.

Press on to the boss, run a drill through each of the holes and rivet securely with 3/32 in. rivets. The whole lot can then be mounted on a mandrel and cleaned up. Cut the other plate in a similar manner, mount on the boss and clamp the two plates together, then run a drill through each of the holes around the edge. Enlarge and countersink the holes on the loose plate and tap those on the corresponding plate 6 B.A.

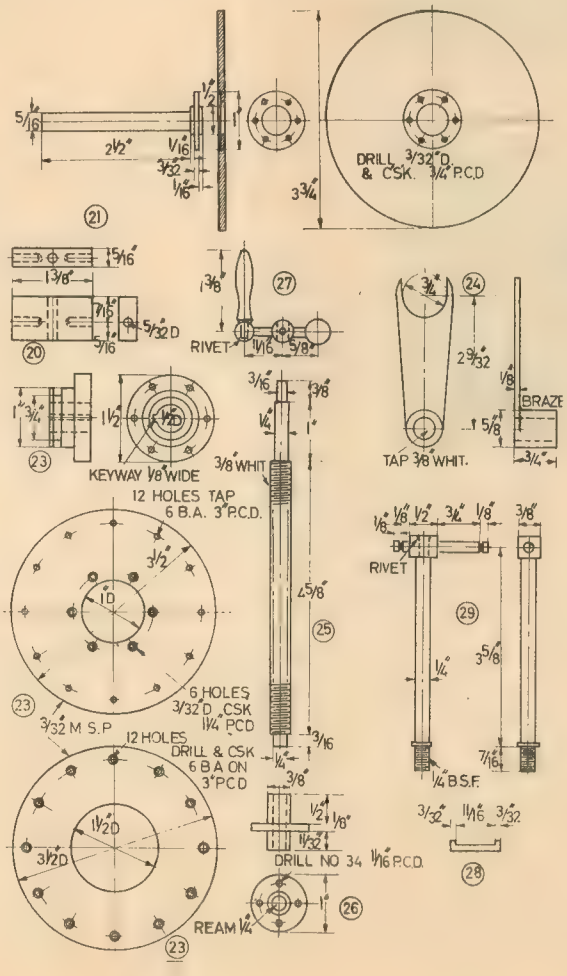
The friction disc is in the form of a washer cut from leather or raw hide; black rubber used for soling shoes is also a good substitute. In any case the power transmitted is very small and any suitable material will last a long time. Sandwich the friction material between the two discs and secure with 12 6 B.A. countersunk screws. Finally add the key, which may be filed up from $\frac{1}{8}$ in. sheet steel.

The operating fork (24) is made from $\frac{1}{8}$ in. steel with a boss brazed on and drilled and tapped standard $\frac{3}{8}$ in. thread. This works on a length of standard Whit. rod, turned down at both ends, the rear end working in a plain unbushed hole drilled in the box and the front end in a brass bush. This bush is turned and reamed as shown in detail 26, being secured to the box with four 6 B.A. screws.

When the machine was first built no precautions were taken to prevent over-running of the operating screw. Since then a thin steel washer has been inserted between the front bearing and the threaded portion of the shaft and a loose sleeve of suitable length slid on to the rear end. As an alternative a couple of screws could be let into the side of the box to check the travel of the operating fork boss. An indicating pointer running in a slot would perform the same job.

A small balanced handle, similar to those on the lathe, is pressed on to the shaft and held by a small taper pin.

Having got the friction wheel


DRILL 3/32" D & CSK. 3/4" P.C.D
RIVET
KEYWAY 1/8" WIDE
3/8 WHIT
12 HOLES TAP 6 B.A. 3" P.C.D.
6 HOLES 3/32" D CSK 1 1/4" PCD
12 HOLES DRILL & CSK 6 B.A ON 3" P.C.D
DRILL NO 34 1 1/16 P.C.D.
REAM 1/4
TAP 3/8 WHIT.
BRAZE
1/4 B.S.F.

Details of the working components

completed and ready to be mounted on its shaft, place the cam in its disengaged position, try the friction wheel on its shaft and if it just clears the driving disc all is well; if not turn down the friction material until it does. The less it clears the longer it will wear without renewing. Mine lasted three years before it began to slip. Even longer service could be obtained by using a larger cam, thus increasing the travel.

Spring assembly

All that remains to go inside the box is the spring assembly, which allows the box to rock on its bearings and throw the worm in and out of gear.

The pillar is securely fastened to the baseplate, the springs lifting the box in an upward direction, causing the worm at the front end to fall. The pillar is turned to the dimensions shown and screwed at its lower end to take a $\frac{1}{4}$ in. B.S.F. nut.

The top carries a bridge piece which holds the two springs. This can be conveniently turned from $\frac{3}{8}$ in. square steel bar with V-grooves cut at each end to prevent the springs from slipping off. A $\frac{5}{16}$ in. hole is drilled in the squared portion into which is riveted the pillar. The lower ends of the springs are anchored to the box bottom with eyes, milled or filed from $\frac{1}{4}$ in. round bar and either held by nuts or riveted.

Unless it is proposed to fit a pointer to indicate the gear ratios, the box will now be complete and attention can be given to coupling it to the leadscrew on the lathe.

The worm in my case was originally cut on the end of a motor shaft. Sufficient for the present purpose was cut off, then mounted in the lathe, drilled and reamed $\frac{1}{4}$ in. One end of the worm was squared up and the other turned down to form a boss. It was then run up to the shoulder on the mainshaft and secured through the boss with a taper pin.

The worm wheel was a lovely piece of work cut in bronze and by a stroke of luck was bored an exact fit for the Myford leadscrew.

Sleeve or collar ?

If there is no leadscrew handwheel on the lathe its place will be occupied by a sleeve or collar. This sleeve was reduced in length to allow the worm-wheel to just clear the end of the lathe bed. The other side of the worm-wheel, on which there was a large boss, was bored out to enable the leadscrew nut to be screwed fully home.

Next a collar was turned to fit the outside of the boss and reduced at the other end to take a micrometer dial. This latter item was originally the top of a motor-car piston and being of aluminium alloy was excellent material for the purpose. It always remains bright and takes the engraving easily.

The end of the leadscrew was drilled and tapped 2 B.A., an easy job to do since the end was already deeply centred and only needed drilling out with a hand-drill, no dismantling being necessary.

A 2 in. dia. springy brass washer, slightly dished and with a cork face glued to it, was next made. Suitable cork washers of this type are generally used to seal the top of screw-capped jars. The cork face of this washer presses against the dial and is followed by a turned steel washer and the lot finally screwed home with a 2 B.A. screw.

Engraving of the dial was carried out in the usual way, using a sharp tool laid on its side in the toolpost and traversed backwards and forwards against a stop. One edge was divided into thousandths, each fifth line being extended and each tenth one numbered. The other edge was divided into sixty-fourths, which is handy for all normal measuring.

Since the dial can be set to zero, one revolution being $\frac{1}{8}$ in., it makes my mental arithmetic appear to be more brilliant than it really is ! To complete the work, a pointer was cut from $\frac{1}{4}$ in. steel and held to the lathe bed by a single screw, the screwed hole in the lathe bed being already in existence. The pointer just clears the dial and has a small engraved line on its upper surface which lines up with the corresponding marks on the dial.

This set-up is clearly shown in the general arrangement drawing. Starting from the bracket which supports the leadscrew, there is the original collar as supplied with the lathe. This is slotted and held up to a pin driven through the leadscrew. This collar was reduced in length, as mentioned above, and is followed by the worm-wheel shown in section. The original nut supplied with the lathe comes next. On the outer boss of the worm-wheel is the stepped collar followed by the dial and lastly the friction washer and bolt.

Fixing to bench

The machine can now be bolted to the bench alongside the lathe and packed up if necessary so that the worm and wheel are in mesh when the cam is in the raised position. Final adjustment of meshing can be made with the split nut under the lifting cam. Make sure that the worm and wheel are in correct alignment in the first place, otherwise the worm may bear more on one side than the other, with a tendency to bind.

As my lathe was already mounted on girders some $3\frac{1}{2}$ in. above the level of the bench the attachment had to be packed up a similar amount, so I utilised this space to take a drawer which is very convenient for the storage of odds and ends, such as packing pieces for the lathe, together with the necessary nuts and bolts.

All that now remains is to connect up the primary drive. This will vary with different types of lathes and depend on whether you choose to take the drive from the mandrel, countershaft or lathe motor. The outfit could, of course, be made an independent unit by mounting a small electric motor on the lid. Since very little power is required, quite a small motor would serve. The motor would, however, have to be of the constant-speed type, otherwise the speed would vary with the load.

As previously mentioned, the drive in my case was taken off the Myford countershaft. A $\frac{3}{8}$ in. shaft running alongside the back of the lathe has a large pulley on the headstock end and a crosspin at the other end to engage the driving socket on the gear-box. Here there is just sufficient clearance between shaft and socket to allow the gearbox to move up and down, no ball joint being found necessary.

The pulley end of the backshaft runs in a self-aligning ball-bearing. The collar on the end of the Myford countershaft was replaced with a similar one having a V-groove cut in it, with an effective working diameter of $\frac{7}{8}$ in. and connected to the back-shaft by a $\frac{1}{8}$ in. rubber belt running on a 4 in. pulley.

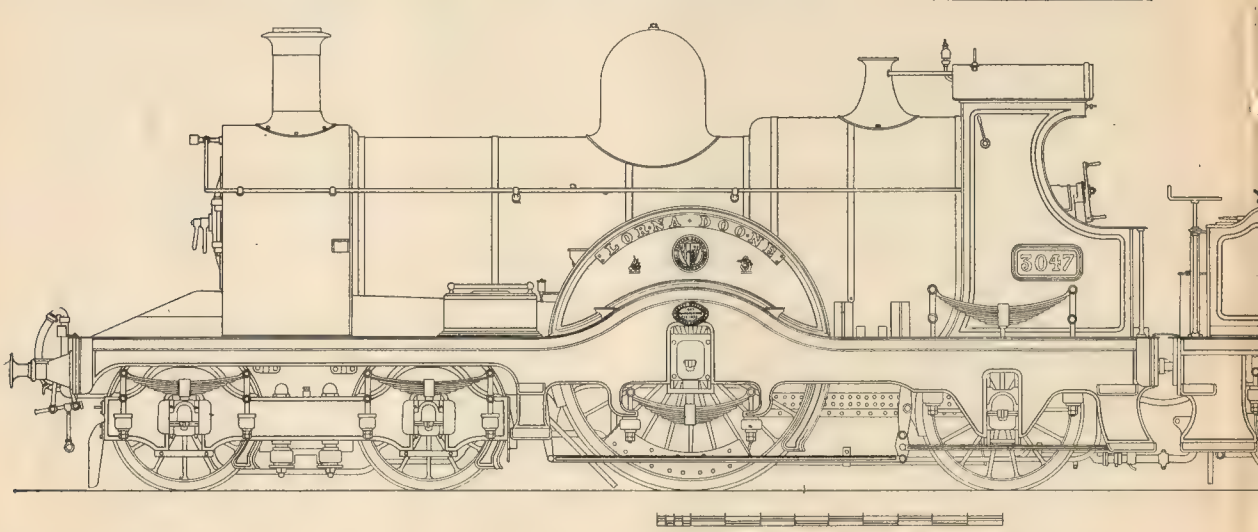
This belt is tensioned by a spring-loaded ball-bearing jockey pulley, since the elasticity of the rubber belt is not sufficient to allow the free movement of the countershaft when changing mandrel speeds on the lathe. The jockey pulley has the further advantage that any type of non-stretch belt can be used.

Incidentally, a very neat endless belt can be made for the purpose with two lengths of $\frac{3}{8}$ in. wide cotton tape. Lay one on top of the other, with an alternative length overlapping at each end, twist severely in the middle and join by stitching what will be two spliced ends. Given a rub over with beeswax, the result should be a neat round belt about $\frac{1}{8}$ in. dia.

The bearing of the large pulley and the spring arm of the jockey pulley are both mounted on a slat of plywood erected at the back of the lathe and at right angles to it. This sheet of plywood, besides supporting the bearings effectively, prevents all lathe cuttings from interfering with the belt-drive and incidentally from getting in that inaccessible place behind the headstock. ▣

LOCOMOTIVES I HAVE KNOWN

NUMBER 24: By J. N. MASKELYNE



GREAT WESTERN RAILWAY

LORNA DOONE

YES, I KNOW ! This article has been a long time coming: the reason is that I have had to make a new drawing.

Lorna Doone was one of a class of 80 express passenger engines which to me, when a boy, were almost sacred. They stood apart from *all* other engines, and they achieved the summit of beauty in locomotive design.

I will not argue on this matter; my opinion was formed just 59 years ago and has remained unaltered ever since—against the test of time and an ever-growing appreciation of the finer details of locomotive anatomy. I should add that this applies to the engines when they were in the condition illustrated in my drawing.

Later, these engines were subjected to various changes of detail, none of which improved the appearance; some very definitely ruined it. However, this famous class originated with No 3031, *Achilles*, in March 1894 and finished with No 3080, *Windsor Castle*, exactly five years later. Meanwhile, 30 earlier engines built as 2-2-2s in 1891-2 were converted to 4-2-2s and added to the other 50 to make up the total of 80. But William Dean excelled himself with their design, producing something unique and of compelling aspect.

Swindon, their birthplace, was justifiably proud of them, and when the town became a borough in 1898, a representation of No 3029, *White Horse*, was incorporated in its coat-of-arms. Further, No 3012, *Great Western*, is the subject of an excellent mural pleasingly built up in coloured tiles on the left-hand wall of the entrance to the Great Western Hotel at Swindon.

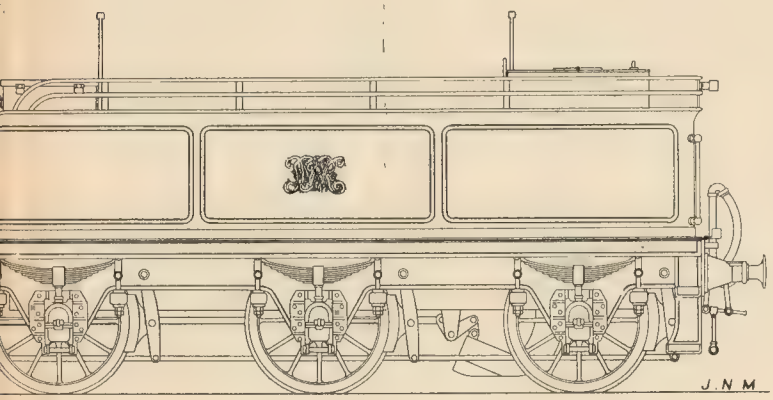
The class has made a strong appeal to model makers—and models have been made. Some are even now in course of construction—in all sizes from 4 mm. to 1 in. scale. Not the least attractive feature was the wonderful series of names these engines carried: *Amazon*, *Courier*, *Dragon*, *Westward Ho!*, *The Queen*, *Lord of the Isles*, *Lorna Doone*, *Majestic*, to mention only a few. The full list embodied romance, mythology, splendour and regality in plenty.

All this was backed up by the generally good work these engines did. The run by No 3065, *Duke of Connaught*, on 9 May 1904, when she covered the 118½ miles from Pylle Hill to Paddington in 99 min. 46 sec. with a 120-ton Ocean Mails special remains a classic. Yet the archives at Paddington show that this was not her fastest run, but is better known because it was her contribution to the astounding Record of Records run from Plymouth to London on that day.

In ordinary work not so much haste was required, and the engines performed their duties in good style for nearly a quarter of a century in spite of their being of an obsolescent type. The class became extinct in

December 1915, with the withdrawal of No 3050, *Royal Sovereign*, and No 3074, *Princess Helena*.

To the man-in-the-street the main feature of these remarkable locomotives was their truly arresting appearance, with its beautiful proportions, green and Indian red livery, black and orange lining and the lavish display of polished brass, copper and steel. Yet this was not overdone. It was just right; any more would have ruined it the way that the very fine



model of No 3048, *Majestic*, at Paddington Station has been spoilt by over-decoration—a pity, because with the exception of the coal-plates on the tender, which belong to a later period, this model is well-nigh perfect.

From the technical angle I always regard these engines as the beginning of that exceptional combination of dimensions and ratios that was so persistently developed at Swindon during the next 60 years. Their chief trouble was, of course, wheel slip when starting, and I can recall some really painful exhibitions of that kind. Yet, on rare occasions, I have seen an engine of this class start a train of ten corridor coaches without any slipping at all. I think a lot depended on how they were handled. There is a story that only two engines of the class were ever seen at Gloucester, simply because the two drivers concerned were the only men who would undertake to get one of these single-wheelers up the Sapperton bank.

The two engines were No 3031, *Achilles*, and No 3048, *Majestic*; I have an old, faded photograph of the latter in Gloucester station, but have never seen another. It is worth noting that No 3080, *Windsor Castle*, differed from all the others in being reversed by a lever instead of by the normal screw gear, and I wonder if this had anything to do with the fact that the work of this engine was never outstanding.

Some of the leading dimensions of these engines were: cylinders, 19 in. dia. × 24 in. stroke; the steamchest was underneath the cylinders, with the valves upside down and direct-driven by a beautifully-designed Stephenson link motion; the width of the steam ports was 2 in., while that of the exhaust ports was 3¼ in., the common length being 14 in. The wheel diameters were: bogie, 4 ft 1½ in. driving, 7 ft 9 in.; trailing, 4 ft 7½ in., and tender 4 ft 1½ in.

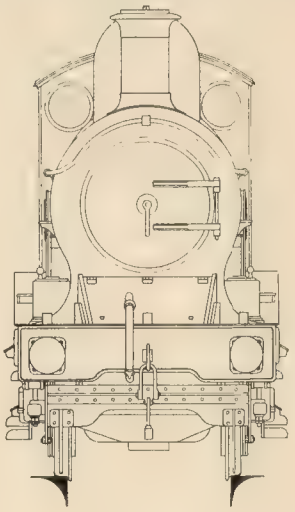
The wheelbase of the engine was divided into 7 ft plus 7 ft 6 in. plus 9 ft, totalling 23 ft 6 in.; the overhang was 3 ft at the front and 4 ft 6 in. at the back. The tender wheelbase was 15 ft. equally divided, and the overhang 4 ft at the front and 3 ft 6 in. at the back.

The boiler was made in two rings, 4 ft 2⅛ in. and 4 ft 3 in. dia.; the barrel was 11 ft 6 in. long and pitched 7 ft 7½ in. above rail level. It had a firebox of the raised round-top pattern, the outer casing of which was 6 ft 4 in. long × 4 ft wide; the inner casing was 5 ft 8 in. long × 3 ft 4 in. wide and was 6 ft 2 in. high. The steam space was augmented by the provision of a very large dome, in which the regulator was housed, mounted on the back ring of the barrel.

There were 266 tubes of 1¾ in. dia. and 11 ft 9¼ in. long; their heating surface amounted to 1,434.27 sq. ft, while the firebox added 127.06 sq. ft to make up the respectable total of 1,561.33 sq. ft. The grate area was 20.8 sq. ft, and the working pressure was 160 p.s.i., at 85 per cent. of which the tractive effort was 12,670 lb.

The tenders for the entire class were of the standard 3,000-gallon pattern, the coal-rails of which were originally kept bright. In 1906, however, a start was made in replacing the coal-rails with raised coal-plates, a disfigurement that rapidly became standard for all types of G.W.R. tenders.

Lorna Doone, one of my special pets in this lovely class, was never rebuilt. She was withdrawn, to my sorrow, in November 1912. ▣



Air flotation for heavy press dies

LOCATING heavy dies in position on a tooling table constitutes a problem, for the movement of grappling tackle is often limited by the structure of the machine.

The Northrop Aircraft works, of Hawthorne, California, have overcome this by installing a pneumatic device which floats the tooling plate and die into position.

Air, at 100 p.s.i., is forced between the top of the press table and the underside of the magnesium tooling plate, creating an air cushion on which loads of 1,500 lb. can be supported at finger-tip control.

When the die is accurately located the air supply, which is fed through six batteries of ⅛ in. orifices, is cut off and the plate and its load instantly settles.

Reporting this innovation, *Machinery* states that accurate positioning could be obtained automatically by installing adjustable cams to cut off the air supply at the required moment. ▣

HELEN LONG

L.B.S.C. reminisces on the conception and development of a unique type of small loco

ONCE UPON A TIME, in the land that lies between the United States of America and the North Pole, there dwelt a young man who was exceedingly skilful in the use of the pencil, compasses and rule; his name was James A. Joslin.

He exercised his skill in the service of a large firm of Canadian constructional engineers; but though he could make a drawing of a steel girder railway bridge that was second to none, his heart was not in the bridge: it was in the locomotives which would run over it.

His spare time was frequently occupied in a kind of busman's holiday in making drawings of locomotives, some of which were of orthodox types, and others to his own design. It was one of his dearest wishes to possess a powerful and speedy little steam locomotive, but being single and living in an apartment house it was not convenient to set up a home workshop and build one.

At that time, there were very few folk in Canada who were interested in little locomotives, and fewer still who could build one; so our friend was unable to find a kindred spirit with whom he could exchange views, and who might perhaps build a locomotive for him.

Naturally, he read whatever literature was available on the subject of small locomotives and he was a regular subscriber to MODEL ENGINEER. In those days the principal writer on small locomotive topics was a gentleman who was also clever with the working tools of the draughtsman and was prolific in designing; so it occurred to our Canadian friend that perhaps this gentleman could get a locomotive built for him in this country.

He got into communication with him through the late Mr Percival Marshall, who was running the magazine from the old offices in Farringdon Street. They corresponded, but the locomotive was not built as the ideas of the British designer did not match up with those of our friend. The former wanted to incorporate his own ideas, while the latter wanted to see the child of his own brain take the rails; so there matters rested.

Hope springs eternal . . .

Eventually the day came when the shot which started the "Battle of the Boilers" was fired and Mr Joslin eagerly followed the progress of the contest, realising that my own ideas on the question of small locomotive design and construction coincided with his own.

The battle was fought and won, and these notes came into being and our friend, thinking that I might be able to help him, got in touch with me. He said that he was shortly visiting this country, and I arranged to meet him at the Farringdon Street offices, take him home, show him my workshop and railway (very modest in those far-off days) and have a look through his drawings.

This programme was duly carried out. He was already at the offices when I arrived with my weekly batch of copy on the well-remembered Monday morning, and I was introduced by the late Mr Walter Runciman who was second-in-command to Mr Marshall in those days. I found Mr Joslin a very pleasant and likeable person and we immediately struck up a friendship which still exists, although it is about 25 years since we last met.

That afternoon he saw the heroine of the battle at work, and was duly impressed. After the inevitable cup of the engineman's best friend I took a look through his locomotive drawings. His idea was to incorporate the proportions of American and Canadian locomotives into British practice and so obtain engines of larger size and greater tractive effort than anything running on British metals at the time.

Among the drawings was one of a heavy-duty suburban tank engine. Our friend said that he designed her with the idea of showing that rapid acceleration with a heavy suburban train, coupled with a high speed between stations, was as practicable with steam power as with electric traction.

He told me of the fruitless attempts he had had to get a small edition of this locomotive built and of his correspondence with the designer, to which I referred earlier. He asked if

Left: The original HELEN LONG *engine*

Right: Allan Reid's Chilean-built 4-6-0 OLYMPIADE *magnificent locomotive*

there was any chance of my being able to assist him. I asked him to leave the drawing with me and I would go into the matter, and I arranged for him to visit me again during the week.

To those who wait

I studied the drawing carefully. It was not dimensioned but was drawn "to scale" for 2½ in. gauge, which works out at roughly 17/32 in. to the foot in full size. The wheel arrangement was 4-8-4 with symmetrical spacing. Only two outside cylinders were shown, but Mr Joslin said that he intended her to have a middle cylinder as well, with 120 deg. cranks, and three sets of valve gear so as to obtain maximum starting torque, good valve events, and even beats.

To provide steam for three cylinders, an enormous boiler was shown, almost to the limit of the load gauge, which reduced the chimney and dome to small proportions. Even though the cab was as high as the chimney top there was little room for a cab front, but as the boiler was round-topped windows could be arranged which would give the driver the necessary view ahead. The side tanks were almost level with the cab roof, but were not unsightly, as the middle part of the running-board was raised to render the valve gear accessible. The coal bunker was as high as the tanks.

I thought, with a smile, that she was just the engine to run the last workmen's cheap train on weekday mornings, which was always long and very heavily loaded; many City office-workers used to travel to London Bridge by that train and wait about in town until their offices opened in order to save paying full fare. She would have made some of the "regulars" open their eyes!

I was now beginning to wonder what sort of a performance she would put up in 2½ in. gauge, seeing what my 4-4-2 *Ayesha* had done; and I decided to build her. As no dimensions were specified I measured up the drawing and found that the bogie wheels worked out at 1⅛ in. dia. and the coupled wheels 3⅜ in.

The outside dimensions of the cylinders shown allowed for a bore of 1⅜ in. and I fixed the stroke at 1⅛ in. As Mr Joslin said that he had not worked out the dimensions of the rods, links, and levers of the Walschaerts valve gear, but had just drawn them in to "complete the picture," I checked these off and made the necessary adjustments to give the proper valve events, providing a huge eccentric on the crank axle to actuate the expansion link of the inside set.

The boiler barrel measured up to 3¾ in. outside dia., so I left it at that and added a 6 in. firebox and as many tubes as I could get in the available space after provision for a superheater.

When Mr Joslin came along later in the week I told him that I thought I could build the engine and he was delighted. He approved my suggested dimensions; but then added other items that he wanted put in. At that time I had done no experimenting with mechanical lubrication. I was using the ordinary displacement pattern, but had added regulating valves.

Mr Joslin suggested three separate lubricators, one for each cylinder, complete with this valve. He also specified his own arrangement of footplate fittings, which included a manifold with a battery of screwdown valves on it to feed steam to the accessories. Then came a dilemma. Our friend said he was only staying in England for a couple of months and was there any chance of taking the engine back with him?

Delivery by instalments!

This was what our transatlantic cousins call a sockdolager. In those days my only machine tools were a treadle-driven lathe, hand-operated bench drill, a tiny hand shaper and a toolgrinder to which I had added a wooden pedal. I had no brazing equipment other than a one-pint blowlamp.

I had plenty of energy as I still retained much of the uncanny "super-human" physical strength which was a feature of my childhood (there is still a little left even at my advanced age, otherwise I could not carry on) but to build the locomotive in the available time was quite impossible, as I explained to Mr Joslin.

He then suggested a way out. If I could build some part of the engine for him to take back I could send the other parts on and he would either assemble the lot himself, or get somebody over yonder to do it for him.

This plan was the obvious solution to the dilemma and it was arranged that I should make an immediate start on the boiler, as that component was more likely to be a straightforward job than the chassis; so I got busy and Mr Joslin paid several more visits, saw the boiler in progress, and finally saw it tested.

As I had no means of brazing the lot, only the firebox was brazed, the tubes being silver soldered; the foundation-ring, backhead, and smokebox-tubeplate joints were close-riveted and sweated up. Incidentally that boiler lasted a very long time; it was only about a couple of years ago that the solder finally began to perish and started some leakage. When Mr Joslin finally departed for home he took the boiler and some fittings with him.

After he left I started work on the chassis. Cast-iron cylinders were specified, and I had to make special patterns for them. Being a poor hand at woodwork I made the patterns in metal, and Stuart-Turner made the castings. I had been having some correspondence with them over something which I cannot now recall and had mentioned about the cylinders,

HELEN LONG . . .

so they offered to cast them; and an excellent job they made of them too. I still have a spare inside-cylinder casting here in my workshop. The rest of the stuff was ordinary stock castings and material.

I had no difficulty in building the chassis with my limited facilities, although it took much longer than it would at the present time; I have less energy but far more equipment—and Milly Amp is a first-class mate who never gets tired !

After a test with a temporary boiler, I carefully packed up the chassis in a wooden crate and consigned it to the tender mercies of Thomas Cook and Son who delivered it safely to Mr Joslin in Toronto, where it was assembled. I should state here that I did not make all the sheet-metal work in the tanks, cab, and bunker; most of that was done either by Mr Joslin or his friends, but all the working parts were made at my old home at Norbury.

I gave the locomotive the name of *Helen Long*, firstly because our friend had family connection with the town of St Helens, Lancs, and my mother's name was Helen. And Long ? Well, the loco was just that ! By the way, a reader of this journal who built one cut off the frame behind the rear coupled wheels, fitted an open-backed cab, added a bogie tender, and called his effort *Helen Longer* !

Not a solitary example

The writer of the reply to P.G.K., Transvaal [November 29, page 783], needs a little correction. I certainly gave a description of how to build the engine many years ago, but the firm he mentions was not then in existence. I gave the cylinder patterns to George Kennion, who had just started business at an address in Old Ford Road, London, E.3, and who was specialising in castings and material to build the engines described in my notes in this journal.

Far from one or two examples being built, quite a lot of castings were sold and I received a number of photographs and plenty of queries and correspondence from builders of the engine; among them was George Perrem of Johannesburg, who still has his version. As a matter of fact I have a partly-completed one here at the present moment, built by the late Tom Lucas of Warsop, Notts, who unfortunately died from the effects of coal-dust in his lungs (he was once a miner) before he could complete the job.

On the first page of this story is the most recent photograph of the original locomotive that I have and there is a picture of her facing page 37 of the *Live Steam Book*. The last I heard of her was that she was still running well and that the valve events were still good, despite the wear, after all the years.

She is well known at the Toronto S.M.E. and has performed the opening ceremonies at more than one exhibition of members' work. She has also been shown running on compressed air with the wheels jacked up, to demonstrate to the uninitiated how a locomotive operates.

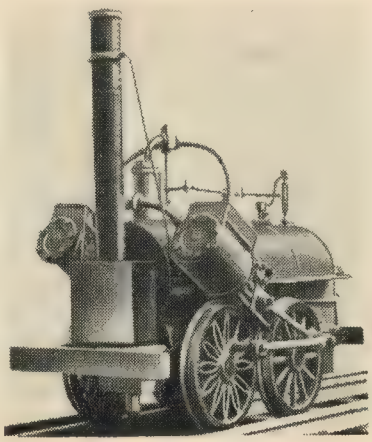
As to drawings, Mr Joslin got out a whole series of blueprints for what he called "Pedigree Locomotives," all super-monsters of similar proportions to *Helen Long*, and of various types, giving them such names as *Uranus*, *Mars*, and so on.

Messrs Percival Marshall and Co. acted as agents for them for many years, and they were advertised in this journal under the title of the "J.A.J." series. There were detailed sheets of components common to all, and some special sheets of separate details, but unfortunately all are now out of print, though I believe Mr Joslin still has the original tracings.

By the time these notes appear, George Kennion will have closed down his shop in Kingsland Road, having reached the ripe old age of 84, although still as lively as a kitten; he has lived right opposite to our hacienda for the past 18 months or so—"birds of a feather flock together," says the old saw !

Castings are therefore no longer available from that source but stock castings for the larger 2½ in. gauge locomotives that I have described could easily be worked in by anybody who wished to build "Helen" in that size. Same applies to blueprints.

Driver S. Herbert's INVICTA



The cylinders and motion of any of the 4-6-0 type locomotives that I have described would suit the 4-8-4 as the outside cylinders drive on the second pair of wheels; and an inside cylinder with independent valve gear, such as I specified for *Olympiade*, could be used to drive on the front coupled axle.

Helen Long in 3½ in. gauge would be a really "Bill Massive" turnout ! It could easily be done by taking the frame drawing of the L.M.S. *Doris* (my 3½ in. gauge Black Stanier 4-6-0), drawing a vertical line across it midway between the second and third hornblock openings, erasing the section behind the line and substituting the complete front half in a reverse direction. This would give the 4-8-4 layout.

Another pair of coupled wheels would be needed and the trailing bogie could be made exactly similar to the leading one; the outside cylinders and valve gear of *Doris* would be O.K. and for the inside cylinder, that which I specified for the Schools class 4-4-0 *Roedean* could be fitted in nicely to drive on the leading axle. The bore of all three should be 1¼ in.

A boiler with a 5 in. barrel, 8 in. firebox, and the tube arrangement specified for *Maid of Kent* would supply plenty of steam. Anyway, should there be any demand, and the editor permits, I would be glad to make a few drawings and furnish further details.

Two interesting jobs

The 4-6-0 shown in the accompanying picture was built by Allan Reid from the blueprints of my 2½ in. gauge L.M.S. *Olympiade*; but as her birthplace was rather a long way from the L.M.S., to wit Valparaiso, Chile, our friend "naturalised" her, as can be seen from the louvred cab window and other details. She is the only 2½ in. gauge coal-fired steam locomotive in Valparaiso, but there are two others of 3½ in. gauge, *Juliet* and *Iris*, both built by Alvaro Orrego of that town, to my instructions published in these notes. They are both very good performers.

The 3½ in. gauge *Invicta* was built by Driver Syd Herbert of Faversham Motive Power Depot (mustn't call it "locomotive shed" nowadays—nothing so common !) and her claim to individuality is due to the fact that, as Syd lives not so very far away from the "old lady who stands in the market place" and is familiar with all the old-fashioned details, he added them to his small version, including all the riveting, and the ancient feed pump. ▣

H. BURGMAN gives details of an accurate method which does not rely on sighting

Quartering loco wheels

For the past seven years I have been a reader of MODEL ENGINEER and during that period quite a few methods to assist in quartering locomotive wheels have been published. L.B.S.C.'s method is very simple on the face of it, but one has to rely on sighting the centres of crankpin and axle.

As some readers may know, I am a jig and tool designer, and the foremost aim in that profession is to design equipment in such a way that the article required is produced as quickly, cheaply and accurately as possible. For that reason, sighting methods are avoided and are only used if no other means are suitable.

I therefore decided to use a method to quarter the wheels of my *Tich* that I have not seen described before. This method does not involve any jigs apart from the one used to drill and ream the crankpin holes. When "knocking up" this jig, use a piece of bar $\frac{1}{2}$ in. × $\frac{1}{4}$ in. × $3\frac{3}{8}$ in., drill and ream two holes the right distance apart as shown on wheel drawing, ream these holes 5/32 in. dia. then carry on as per L.B.S.C.'s words and music.

To quarter the wheels the jig has to be slightly modified. Remove the $\frac{5}{16}$ in. dia. button wheel which located the drill jig in the wheel bores and face the head down to $\frac{1}{16}$ in. thick and press it back into the jig.

I must mention here that to make this method work satisfactorily the centre lines of the holes must be parallel with one side of the bar.

Open out the other 5/32 in. dia. hole to $\frac{3}{16}$ in. to fit the leading crankpin. Press the first wheel into the axle, but don't press it right home, let the end face of the axle stop $\frac{1}{16}$ in. short of the front face of the wheel, i.e., this will be a recess $\frac{1}{16}$ in. deep when looking at the front face.

Fit the right axle boxes and eccentrics as described by L.B.S.C. Line the other wheel up by sighting and press it on for a short distance, say $\frac{1}{8}$ in. Mount the whole box of tricks on to a V-block to which a clamp can be fitted (mine is similar to the Eclipse V-blocks but is home made).

Insert a piece of brass strip between the clamping screw and the axle to avoid damaging the axle and lightly tighten the screw. Push the lining up the bar (ex-drill jig) over the crankpin until the button fits in the $\frac{1}{16}$ in. deep recess. Set the V-block on something flat; I used the cross-slide after removing the topslide.

Turn one wheel so that the bar is at right angles to the surface plate or cross-slide and keep turning until no light shows between the setting bar and square. To be more accurate put a piece of cigarette paper between top and bottom of the try-square blade and setting bar and apply slight pressure. If neither paper can be moved by gentle pulling, everything is O.K. Refer to the drawing showing the square in position.

Clamp the axle down really tight and re-check. If all is well, remove setting bar. Fit the setting bar to the other wheel, turn the V-block through 90 deg. and repeat the whole procedure.

When true carry the whole box of tricks to the vice and press the wheel nearly home. Check again to make sure that the wheels have not moved, then press both right home. Open out the $\frac{3}{16}$ in. dia. hole to $\frac{1}{4}$ in. to fit the driving crankpin. Give the other wheels the same treatment.

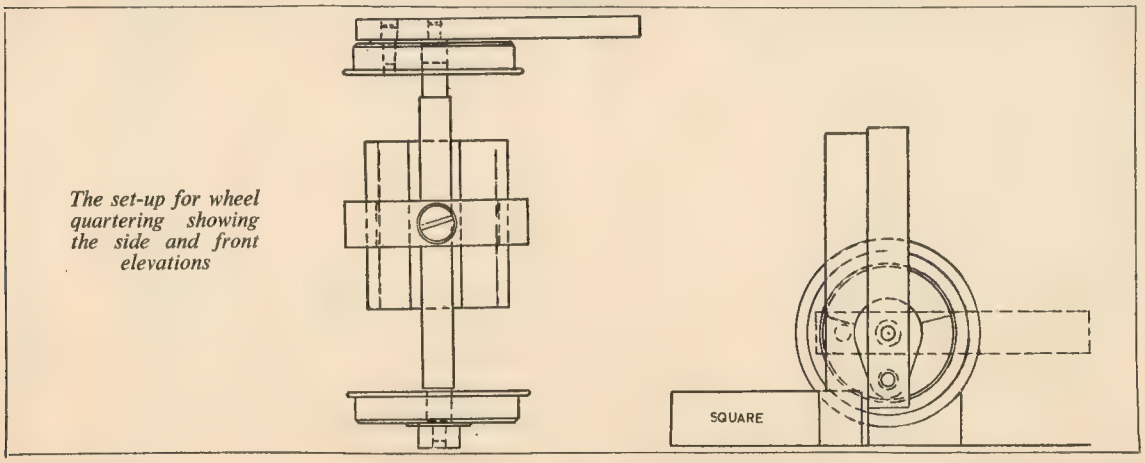
It takes less time to quarter the wheels than it takes me to write this. Although I have great respect for L.B.S.C. (he certainly makes things clear to the non-professional) I am fairly confident that this method is much more accurate. After all, 0.005 in. is sufficient to make the wheels bind, but it would not be a very big sighting error.

The connecting rods were drilled and reamed in the following manner. Set the rod up on the vertical-slide and drill and ream the first hole $\frac{1}{4}$ in. dia. and insert a short piece of $\frac{1}{4}$ in. dia. silver steel in the hole.

Now chuck a piece of $\frac{1}{4}$ in. or $\frac{5}{16}$ in. dia. silver steel in the three-jaw chuck. Check the centre distance of the axles on the actual job and add $\frac{1}{8}$ in. which is half the diameter of the piece of silver steel in the rod and half the diameter of the piece of bar in the chuck to this measurement.

Move the saddle until the rod touches the bar in the chuck and wind the cross-slide in or out as the case may be until the distance over the bar in the connecting rod and the bar in the chuck is exactly the same as the measurement referred to above.

Drill and ream $\frac{5}{16}$ in. dia., press in the bronze bushes and the rod should fit perfectly. ▣



The set-up for wheel quartering showing the side and front elevations

50 years ago

Looking back to a new year . . . to an old-time party favourite which featured a skeleton that danced " a horrid, rattling jig !"

HALF A CENTURY AGO—at this time of the year—some MODEL ENGINEER families were becoming rather tired of father's Ghost. This phenomenon, typical of the Victorian and Edwardian delight in mechanical ingenuities, was a favourite during the season of pantomimes and parties.

The ghost was father's only in the sense that he made it. Otherwise it belonged to someone called Pepper. Briefly, a person was called on to the stage, placed in a coffin, covered with a shroud and made to disappear—not suddenly, but by slow and eerie degrees—until nothing was left of him but his skeleton, which then danced a horrid, rattling jig. Everyone enjoyed it, though it was a relief (especially for the smaller children) to see the skeleton disappear and its owner come back, visibly complete and alive.

Pepper's Ghost was explained to MODEL ENGINEER readers by G. T. Swarts, junior, a contributor in the U.S.A. This is what he wrote:

" The explanation is very simple. Between the audience and the coffin is a sheet of transparent glass inclined at an angle so as to reflect objects located behind the scenes, but so clear as to be invisible to the audience and the man in the coffin. At the beginning the stage is lighted only from behind the glass, hence the coffin and its occupant are seen through the glass very plainly. The lights in front of the glass (behind the scenes) are now raised there gradually as those behind the glass are turned down, until it is dark there. The perfectly black surface behind the glass now acts like the silver backing for a mirror, and the object upon which the light is now turned—in this case the skeleton—is reflected in the glass, appearing to the audience as if really occupying the stage."

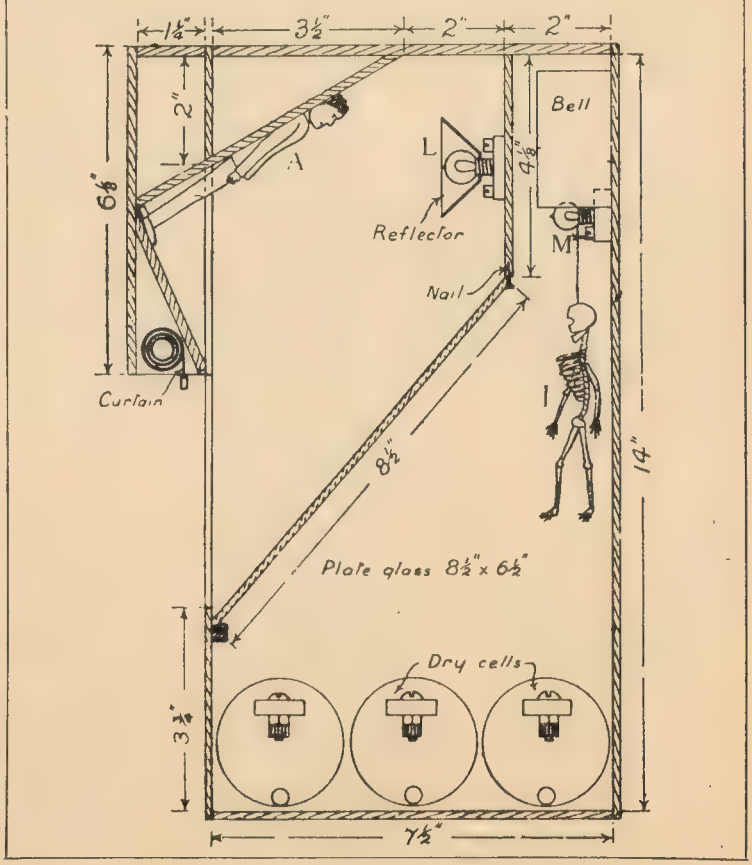
Having explained the trick Mr Swarts proceeded to describe the construction of a model:

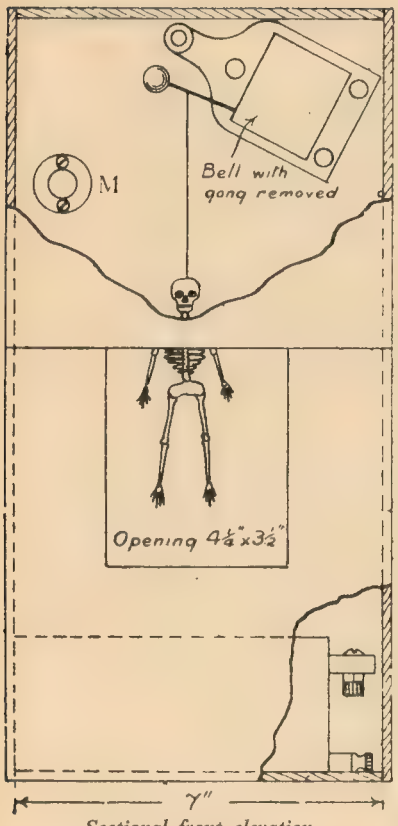
" The box containing the stage should be 14 in. × 7 in. × 7½ in. inside dimensions. The box should not be made of particularly good wood as the entire interior, with the exception of the glass, figures and lights, should be coloured a dull black. This can well be done by painting with a solution of lamp-black in turpentine. If everything is not black, especially the joints and background near *A*, the illusion will be spoiled.

" The glass should be the clearest possible, and must be thoroughly cleansed. Its edges should nowhere be visible, and it should be free from scratches and imperfections. The figure, *A*, should be a doll about 4 in. high, dressed in brilliant, light-coloured garments. The skeleton is made of papier mâché, and can be bought at Japanese stores. It should preferably be one with arms suspended by small spiral springs, giving a limp loose-jointed effect.

" The method of causing the skele-

Transverse section through the illusion box





Sectional front elevation of the illusion box

ton to dance is shown in the front view. The figure is hung from the neck by a blackened stiff wire attached to the hammer wire of an electric bell, from which the gong has been removed. When the bell works he will kick against the rear wall and wave his arms up and down, thus giving as realistic a dance as anyone could expect from a skeleton.

"The lights, *L* and *M*, should be miniature electric lamps, which can be run by three dry cells. They need to give a fairly strong light, especially *L*, which should have a conical tin reflector to increase its brilliancy and prevent its being reflected in the glass.

"Since the stage should be at some distance from the audience, to aid the illusion, the angle of the glass and the inclination of the doll, *A*, have been so designed that if the stage is placed on a mantle or other high shelf the image of *A* will appear upright to an observer sitting in a chair some distance away, within the limits of an ordinary room. If it is desired to place the box lower down, other angles for the image and glass may be found necessary, but the proper tilt can be found readily by experiment."

For the electrical connections the reader needed a two-point switch to put either *L* or *M* in circuit with the battery, and a press button in circuit with the bell and its cell. If desired, a gradual transformation could be worked by means of a double-pointed rheostat, resistance coils being inserted and removed so that one light dimmed as the other became brighter.

"With a clear glass and a dark room," the article concluded, "this model has proved to be fully as bewildering as its prototype."

Still had that medal!

EARLY in 1907 MODEL ENGINEER published a picture of the steam yacht which won a silver medal in the M.E. Model Speed Boat Competition for the previous year. Beside the yacht—which was shown with three steam engines and a small power gas engine—stood the modeller, a smiling young Cardiff man called J. M. G. Tillett.

Jack Tillett, still smiling, was carrying that medal in a waistcoat pocket when Joseph Martin of MODEL ENGINEER met him, quite unexpectedly, at the South Wales and Monmouthshire exhibition exactly half a century later.

In 1907 he had already been modelling for a number of years and the engines shown in the picture represented some of his finished work. Besides winning the silver medal (for boats under 4 ft 6 in. long) he had met with success in a recent M.E. Workshop Problem Competition.

The yacht *Doris*, said the accompanying article, was fitted with compound engines, $\frac{7}{8}$ in. × $1\frac{1}{4}$ in. × 1 in. stroke, working at 50 lb. pressure. Her boiler measured 13 in. long × $5\frac{3}{4}$ in. diameter and had a single flue of 3 in. diameter provided with 14 cross-water tubes with a diameter of $\frac{5}{8}$ in. A large paraffin blowlamp heated the water.

Mr Tillett cut the hull out of a solid block of pine 5 ft × 8 in. × 9 in. Of three propellers used, he found that a three-bladed one gave the best speed.

At the trial, over a course of 327 yards, the steam was turned on and the boat held for 15 sec. She was then let go, to make the trip in 1 min. 49 sec. Steam pressure fell to 28 lb. and again reached 50 lb. on the return trip, which was completed in 1 min. 46 sec.—the performance on which the officially recorded speed was based.

"The boat," MODEL ENGINEER concluded, "appears to be a large one for its length, and we suppose has a greater displacement than any other competing boat in its class. Does this point to the advisability of building a beamy boat for a model speedboat competition where a length-limit measurement obtains rather than a long, narrow model of the T.B.D. variety?"

With the dawn of another year, all readers of MODEL ENGINEER will wish Mr Tillett many more fruitful hours in the place where he is always happy—his workshop.

In the new year, too, MODEL ENGINEER published this new item, which we may read with interest at the beginning of 1957:

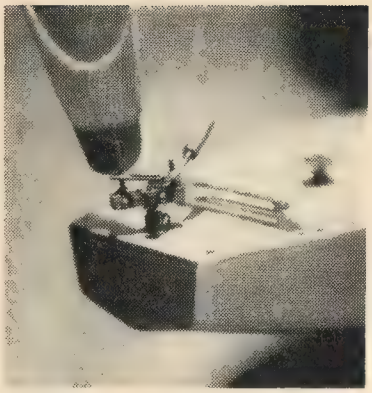
"There was launched, on November 29, from the yard of Messrs Napier and Miller, on the Clyde, a sailing vessel specially designed for the carriage of oil in bulk. The vessel is named the *Sunlight*, and has been built to the order of Messrs Lever Brothers, the soap makers, Birkenhead. She is 230 ft long by 37 ft beam, and is divided by bulkheads into 10 oil compartments, additional to which is a space for general cargo. ▣

BULB ON THE FLOOR

ON entering the workshop one morning I was surprised to see lying on the floor the glass bulb from my ceiling electric lamp and, on looking up, the remainder of the lamp was still in place, with the filament intact.

This lamp had only been in use for about three days and it was certainly in good order when I left it the previous night. I could not resist switching on. The result was somewhat like a magnesium flare; a little ring of white smoke wreathed upwards and curled slowly around the shade.

This was a chain-store lamp, and while buying another I mentioned the trouble to the assistant who said I should have returned it. "They are guaranteed for 1,000 hours you know," she remarked. I took it back next day and it was replaced.—M.C. ▣



By MANUEL LEITÃO

⋆ An original VANE GEAR

For a few shillings you can make this simple —yet well-proven—vane devised by our contributor, a well-known Portuguese model yachtsman

READERS with limited resources and restricted facilities may, I feel, be interested in a description of a simple vane gear which I designed and made for my 30 in. model yacht *Debutante*.

I modified the rigging and deck fittings to suit some of my own ideas. Noteworthy items are: No 2 screws with drilled shanks and their heads cut off (see Fig. 1) instead of screw-eyes to hold the jackstays in place (if these screws are introduced into the spars until the holes are flush with the wood, the jackstays will lie right up against the latter); a radial jib-boom; tracks for the jib and main sheets, of my own design, instead of the unsightly wire horses usually installed (see sketch, Fig. 2, and pictures); a similar track for a kicking-strap, which I found indispensable if the sail was to remain properly shaped; eight-strand woven nylon fishing line for all running gear (a half hitch and whipping are indispensable to prevent the nylon from slipping at the runners, hooks, etc.—but this line is waterproof, rot-proof, slightly elastic and very flexible); stainless steel standing gear (nine strands of 0.005 wire); little runner buttons, similar to deadeyes, instead of bowsers, for neatness, Fig. 3.

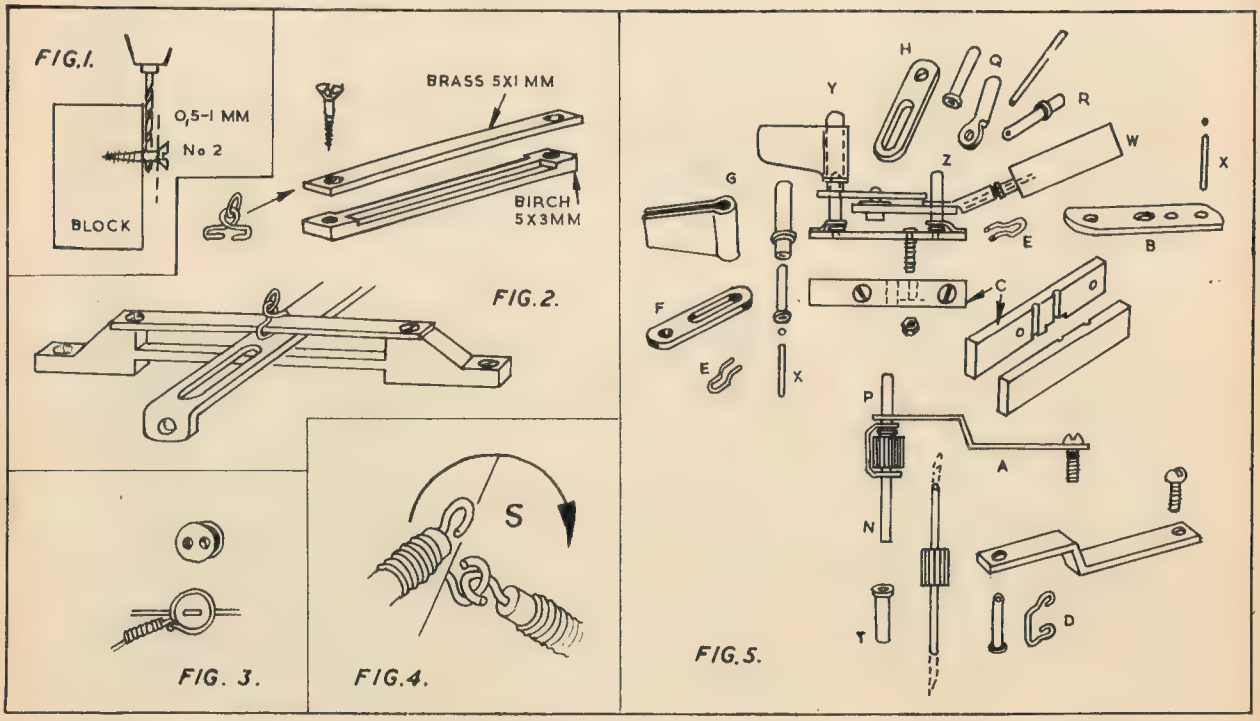
I have also rigged a removable spinnaker boom (see sketch *S*, Fig. 4), located high on the mast, for use with a medium-sized spinnaker. This sail works very well provided conditions are suitable; but it tends to foul the jib when the wind is too light.

Materials (all brass) see Fig. 5

Strip, 5 × 1 mm., 6 in.
Strip, 15 × ½ mm., 3 in.
Wire, 3/64 in., 6 in.
Wire, 1/16 in., 3 in.

Modified rigging details

Details of the vane gear



Bolts, 2 in. × 3/32 in. dia.
Square nut, 5 × 5 mm. (to fit bolts), 1
Bolt and nut, 1 in. × 1.5 mm. dia.
Wood screws, $\frac{3}{8}$ in. No 2, 2
Radio valve prongs, 5 in. × 3/32 in. dia.
Radio valve prong, 1 in. × $\frac{1}{8}$ in. dia.
Wire terminal 3/32 in. tube $\frac{1}{16}$ in. hole, 1
Rod, 2 in. × $\frac{1}{4}$ in. dia.

CONSTRUCTION

Socket T

Drill a hole in the wood of the stern—of the same diameter as that of a small prong—and insert the latter, *T*, after cutting off its short end flush with the shoulder. This part will serve as a socket for the main pivot, *N*.

Main pivot N

I used a double-ended stainless steel injection needle from a disposable transfusion kit. But this part can easily be made out of a piece of $\frac{1}{16}$ in. wire, introduced into a piece of $\frac{1}{4}$ in. dia. rod and soldered in place. I opened out the lower end of my main pivot slightly (tube), to prevent it from coming through socket *T* of its own accord. If wire is used the lower end could be compressed slightly to produce the same effect.

Tiller arm A

Use a flat brass strip, either straight or bent, as required, and drill through both ends. This strip should be shorter than the tiller on the rudder post to give the vane a mechanical advantage.

Drop an ordinary bolt into one of the holes, and slip the other end of the tiller arm over a prong, *P*, which has had its short end cut off at the shoulder. Solder both bolt and prong in place.

Clip D

This part is made of 3/64 in. wire, and joins prong *P* to main pivot *N*. It should not be put on too tight, in order that the rotation of the tiller arm might be as free as possible.

Clamp C

The clamp is made of fairly hard wood, with some elasticity in it. I used birch for mine. Make this part in two halves and file each crosswise to take prong *P* and the bolt which unites base plate *B* and the clamp. The grooves for prong *P* should be very shallow, only deep enough to keep the parts at right angles; these grooves exert a tightening action which would be impossible if they were filed to the diameter of the prong.

Note that there is a little recess to take the nut of the bolt, and that the two pieces of wood are joined by the plain woodscrews, with their tips filed flush where they come out of the wood.

Baseplate B

Drill a strip in four places as shown. The central hole admits the tip of prong *P*; the holes at the ends are to hold pivots *X*; and the fourth hole is for the bolt joining *B* to *C*.

Pivots X

Make these out of $\frac{1}{16}$ in. brass wire and swage them to *B*.

A $\frac{1}{16}$ in. ball-bearing goes on top of each pivot, and carries either assembly *Y* or assembly *Z*, as the case may be.

Assembly Y

This is composed of a prong similar to prong *P*, of a brass strip, *F*, another prong of the next size (medium) making a fairly close fit over the smaller one and a strip of thin brass bent over and filed to shape, as shown at *G*. All parts are soldered to one another.

Assembly Z

Make this assembly with a prong similar to prong *P*, a brass strip, *H*, and a wire terminal, *Q*. Solder all the parts together. Arm *H* carries a bolt which is held in place by the square nut. This bolt engages in the slot made in part *F*.

Weight W

Drill a piece of rod to take a $\frac{1}{16}$ in. piece of wire, slip the latter into a

● *Concluded on page 75*

Method of fixing the vane in the holder

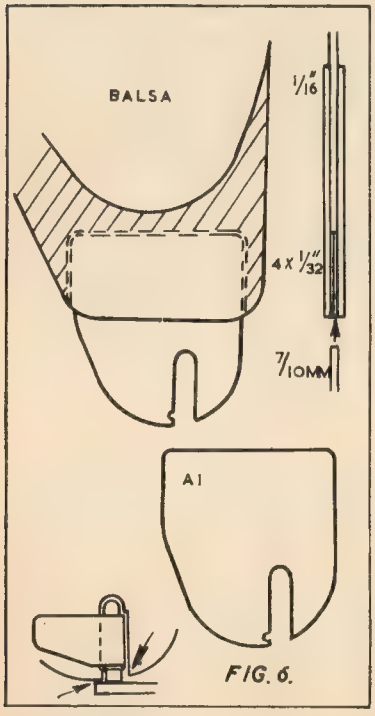
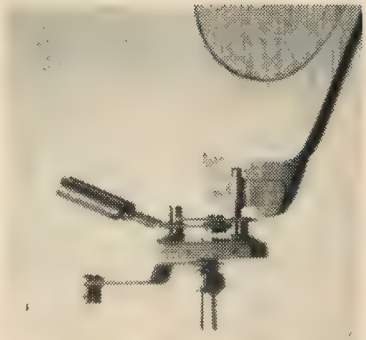
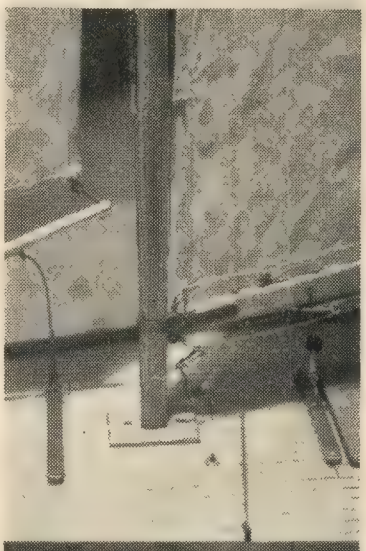
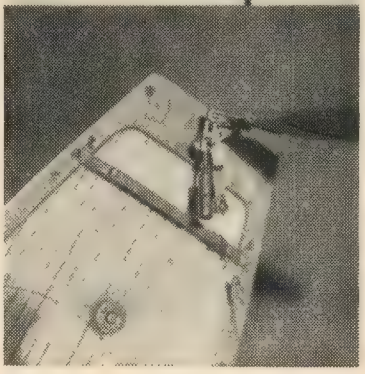


FIG. 6.







Top: The vane gear showing the vane in position

Centre: The track and runner for the kicking strap

Below: The vane gear from above. Note the quadrant from the Braine gear is used as the tiller

Expert's Workshop

A PAINT SPRAY GUN

The second article in the three-part series by DUPLEX

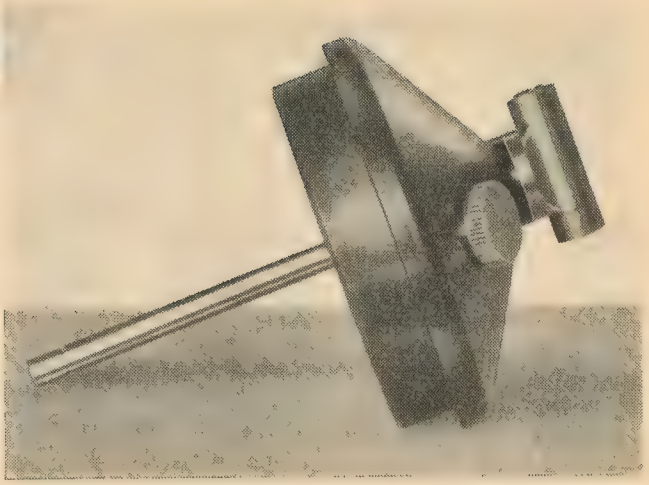


Fig. 7: Top of the container showing T-piece and suction tube

THE body is, in effect, an assembly consisting of a T-piece, *A*, the long tube, *A*1, the short tube, *A*2, and the suction tube, *A*3. Dimensions for these components are given in Fig. 6, while the T-piece and the suction tube may be seen attached to the lid of the container in Fig. 7.

The T-piece may be made from any piece of convenient material, such as brass or light alloy. The work is first marked out and then caught in the four-jaw independent chuck so that the $\frac{1}{2}$ in. dia. spigot may be turned and threaded $\frac{1}{2}$ in. × 26 t.p.i. (It is quite in order to use a die to cut this thread provided that the die is held in a holder designed for use in the tailstock.)

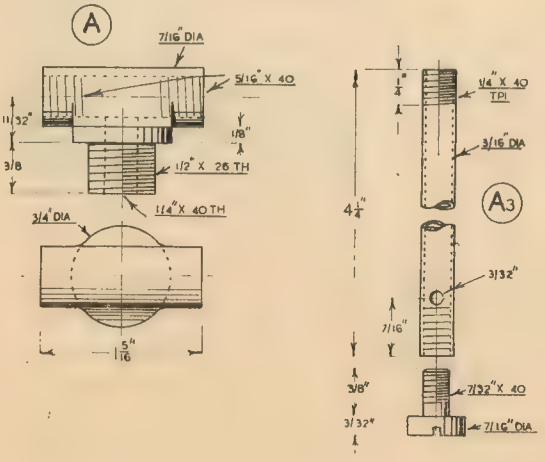
The T-piece, while still held in the independent chuck, is now drilled and tapped $\frac{1}{4}$ in. × 40 t.p.i. to receive the suction tube, *A*3. When this work has been completed the partly finished T-piece is removed from and re-mounted in the four-jaw so that the 9/32 in. dia. bore may be formed for the $\frac{5}{16}$ in. × 40 t.p.i. thread to receive the two tubes, *A*1 and *A*2.

At the same time the $\frac{7}{16}$ in. dia. dimension may be formed at one end only. But the work will have to be mounted on a screwed mandrel to turn the work to this dimension on the opposite end as well as to tap the internal 40 t.p.i. thread. This screwed mandrel must also have a plain portion 9/32 in. dia. at its outer end in order to support the work properly (Fig. 8).

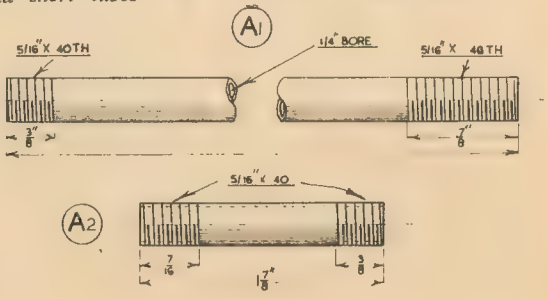
The two tubes, *A*1 and *A*2, are made from light gauge tubing having an outside diameter of $\frac{5}{16}$ in. and a bore of $\frac{1}{4}$ in. dia. Some time ago I was fortunate in buying a quantity of tinned steel tubing of aircraft quality that is ideal for the purpose as it is amply strong. A good quality brass tube will also serve very well, however, and there will be sufficient strength at the thread roots provided that the finished spray gun itself receives fair treatment.

The tubes are sawn roughly to length and are then chucked and faced squarely before threading. Again, the tailstock die-holder must be used as it is imperative not to crush the tubes during the process. Holding the work in the self-centring chuck will ensure that no damage occurs.

Below, Fig. 6: The T-piece and suction tube



Below: The long and short tubes



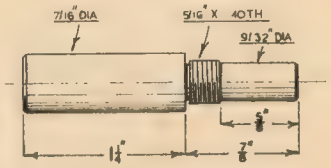
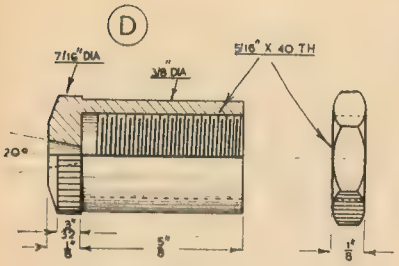
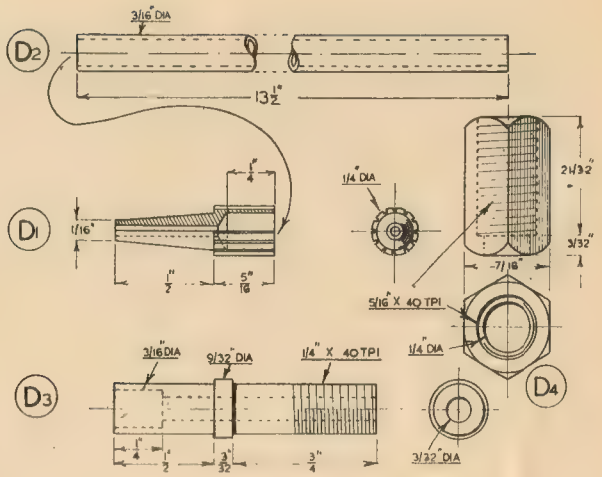


Fig. 8: Mandrel for machining the T-piece



Left, Fig. 9: The combining cone and lock nut



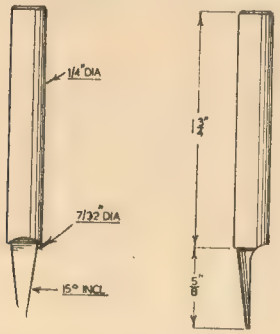
Right, Fig. 11: Air tube, air jet, adapter and nut

The suction tube, *A*3, is best made from a length of $\frac{1}{4}$ in. dia. steel rod which can be drilled axially $\frac{9}{16}$ in. dia. and tapped 7/32 in. × 40 t.p.i. at one end only. The $\frac{1}{4}$ in. × 40 t.p.i. external thread at the opposite end of the tube is formed as for tubes *A*1 and *A*2 by means of the tailstock diehholder.

I come now to the combining cone or spray nozzle, *D*. This part is made from brass rod to the dimensions given in Fig. 9. There is nothing difficult in machining this component, but it should be noted that it will be necessary to make a D-bit reamer in order to form the cone in the spray nozzle through which the gun discharges its contents.

After the combining cone has been bored to the correct size—that is 9/32 in. dia.—the thread is cut by means of a tap held in the tailstock drill chuck. The work may then be knurled where needed and parted so that it may be reversed in the chuck to enable the special reamer to be used to form the cone.

D-bit reamers are quite easily made from a length of silver steel rod. The material is first chucked so that one end can be turned to the correct cone angle—in this case 15 deg. When this work has been completed the coned end of the tool is filed to half its diameter plus 0.002 to 0.003 in. after which the reamer is hardened and tempered. The tool is shown in Fig. 10.



Left, Fig. 10: Reamer for machining the combining cone

THE AIR TUBE ASSEMBLY

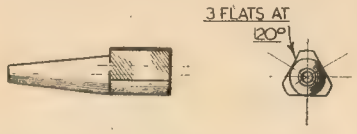
The air tube assembly consists of the air jet, *D*1, and the air tube, *D*2, together with the adapter, *D*3, and the union nut, *D*4; all parts are depicted in detail in Fig. 11.

The tube itself consists of a length of brass tubing $\frac{3}{16}$ in. o.d. To this tube the two parts, *D*1 and *D*3, are attached either by silver or soft soldering, the latter being quite a satisfactory method.

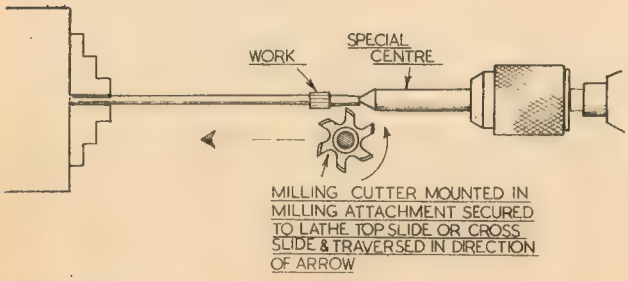
The air jet, *D*1, is made from brass rod by simply turning and drilling in the lathe. The slots that run longitudinally down the component are best formed by milling. Those who possess lathe milling equipment will find no difficulty in carrying out this work, for it is similar to gear cutting and is best performed after the air jet has been attached to the tube. The work can then be held in the chuck for indexing while the free end of the assembly is supported by a special centre held in the tailstock chuck. The method is shown in Fig. 12.

Those who do not have these facilities are advised to file three flat surfaces on the plain portion of the component. In this way the air jet will be supported centrally while there will be ample space for the discharge of fluid from the container. This alternative is illustrated in Fig. 13.

● *To be concluded.*



Above, Fig. 13: Alternative type of air jet


WORK
SPECIAL CENTRE
MILLING CUTTER MOUNTED IN MILLING ATTACHMENT SECURED TO LATHE TOP SLIDE OR CROSS SLIDE & TRAVERSED IN DIRECTION OF ARROW

Left, Fig. 12: Cutting the slots in the air jet; plan view

BELT DRIVES

Belt Drives in the Small Workshop by Duplex is a small useful book dealing with light transmission belts in all forms suitable for small power. It costs 3s. 6d. plus 3d. postage if ordered from the publishers, Percival Marshall and Co. Ltd, 19-20, Noel Street, London, W.1. (U.S.A. and Canada $1.00).

READERS' QUERIES

Do not forget the query coupon on the last page of this issue

This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20, Noel Street, London, W.1.

Woodcarving tools

Could you give me some information on powered woodcarving tools—in particular a tool for cutting vertically round a design (to a depth of, say, ¼ in.) preparatory to carving away the waste wood from the surrounds ?—P.Y.P., Chichester, Sussex.

▲ *This type of tool is known as a "router" and is usually employed in a form of machine tool in which the path of the cutter can be precisely controlled by means of a pantograph or similar mechanism. It is, however, possible to control the cutter by means of a metal template attached to the work. In some cases, the cutter has a plain portion—in others a loose roller, which makes contact with the edge of the template and thus guides the cutter. The latter is usually of a very simple type, having two blades (in some cases only one) and is run at very high speed, usually by mounting it directly on the shaft of an electric motor.*

Swedish iron

I should be obliged if you can recommend a firm which will supply a modeller with a small amount of Swedish iron, suitable for electro-magnet cores.—G.W.B., Rushden, Northants.

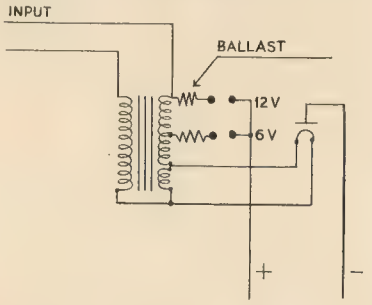
▲ *This material is very difficult to obtain at the present time. Most electro-magnets of modern design now employ laminated cores and many alloys which are superior to Swedish iron are used for this purpose. If, however, it is absolutely essential to use solid cores, ordinary mild steel, full annealed by heating to red heat and cooling very slowly in ashes or dry sand, will be found satisfactory.*

Rectifier circuit

I have recently acquired a 5 amp General Electric Tungar bulb and want to make use of it for charging 6 and 12 volt batteries. I would appreciate a diagram of the transformer and bulb showing the charging of a battery; also the voltage and current in each of the various coils. My mains are 115 v., 60 cycles. I have a transformer core and sufficient information to enable me to calculate the number of turns.—G.M.H., Hudson Heights, Quebec.

▲ *The connecting scheme is shown in the drawing reproduced. Rectifiers of this type vary as to their respective operating voltages and currents. For a rectifier having an output of 3 amps at 12 v., the anode voltage would be 20 v. and the heater 2 v. at 2 amps. For a current output of 6 amps the anode voltage would be 25 v. and the heater 2.3 v. and 18 amps. This data is taken from two Tungar type rectifiers of standard makes.*

It would be better for you to contact the makers who would furnish the correct voltages and currents for the particuliar rectifier valve you have. It is usual to use an auto-transformer with the valve, using a tapped secondary for the two voltages. A ballast resistance or barreter is used to limit the charging current to the value required. If variation of the charging current is needed,



the ballast can be arranged as a variable resistance, with a fixed portion acting as the limiter.

Washing copper boiler

I would be grateful if you could advise me on the best chemical to use to wash out my steam locomotive boiler. Ordinary washing soda makes it prime badly though this effect wears off in time. The fittings are of brass with stainless steel needle valves. The boiler is "blown down" after each 20 hours' steaming.—M.D.M., Swansea.

▲ *There are certain commercial preparations available for this purpose, but diluted sulphuric acid would give quite satisfactory results so long as it is not left in contact with the metal for too long and that it is eliminated by several rinses with clean water. Many readers use waste acid from accumulators for this purpose and some have also reported success with spirits of salts (hydrochloric acid) diluted to about half strength and used in the same way.*

On calibrating

I have a moving coil volt meter (0-20 v.) which I have modified to use as an m.a. meter by connecting an extra lead on the coil side of the fixed resistance. Unfortunately the resistance was not marked, and I am now at a loss on how to calibrate the instrument. Can you help me ?—R.J.H., Cambridge.

▲ *The simplest and most satisfactory method of calibrating an instrument of this type in the absence of elaborate test gear is to connect another instrument of known accuracy in parallel with it and adjust the amount of resistance for the instrument under test until the readings are the same. To avoid risk of burning out the instrument while testing, it is advisable to start with a resistance definitely known to be too high and reduce this by unwinding turns or taking tappings until the correct balance is obtained.*

Building "Butch"

I am building the L.M.S. *Butch* 0-6-0 tank 5 in. gauge but am experiencing great difficulty, having no previous experience. My predicament is further increased by the fact that I cannot obtain any descriptive matter for this model. Can you tell me of any book giving constructional details ?—W.H.C., Southend-on-Sea, Essex.

▲ *The model* 0-6-0 *tank engine* BUTCH *for 5 in. gauge by Kennion Bros. (Hertford) Ltd, has never been the subject of any book or article giving complete constructional details. But a book that deals with the construction of model steam locomotives of all sizes generally is "Greenly's Model Steam Locomotives" by E. A. Steel.*

Making small springs

Can you tell me where one can obtain small quantities of hard rolled brass sheet from 0.004 to 0.030 in. thick for making small springs ? Half-hard brass is not satisfactory for these parts.—P.R.W., Northwood, Middx.

▲ *It is more likely that you would obtain better results by using phosphor bronze—assuming that steel is unsuitable. Phosphor bronze strip in all thicknesses can be obtained from Messrs H. Rollet, 6, Chesham Place, London, S.W.1.*

POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

SWEDISH VIEW

SIR,—With regard to Vulcan's dilemma over the significance of the amber light in traffic signals, perhaps the Swedish interpretation of its purpose will help him.

In this country learner-drivers are taught that when the amber appears with green it means "clear the crossing." This is helpful when a driver wishes to turn right but is held up by the flow of traffic and it exonerates him from "jumping the lights."

The amber appears with green in Sweden a few seconds before it lights with red on the opposing crossing thus allowing a margin of time for the crossing to be cleared. Incidentally, Swedish traffic travels on the left as in England, but the steering, on the contrary, is also on the left.

Gothenburg, Sweden. F. A. YORK.

PUSHROD OUTDATED

SIR,—Dr Joseph Bayley [Postbag, December 6] implies that I have missed the point of Mr L. W. E. Hartley's letter on i.c. valve operation. Before he jumps to conclusions let us remember that "the mechanical atrocity" is *his* term, not Mr Woodward's. Likewise, "the essence of mechanical immorality" is Mr Hartley's interpretation of a letter which listed undeniable advantages.

My own question to Mr Hartley mainly concerned his second point in which he maintains that benefit is only manifest after everything else has been done to improve a racing unit.

With this I cannot agree; for sound mechanical principles and good design must not be lost sight of at any time; they are, or should be, regarded as an ideal well worth striving to attain. Even with an industrial engine the inherent advantages of the o.h.c. layout would allow the use of lighter valve springs, with correspondingly lighter bearing loads; and longer life would result.

It is certain that it is not necessary to think in terms of "dope" fuels, blowers and 12,000 r.p.m. before these fundamental laws apply. Do you not agree, Dr Bayley?

My next query to Mr Hartley concerned the examples he quoted, all save one of which were more historically interesting than they were technically convincing!

Finally, in spite of Mr Hartley's view to the contrary, I think that for serious racing purposes the push-rod engine *is* outdated and outpaced. It would appear that a whole host of British and Continental racing car designers think likewise.

Coventry. THOMAS F. CARTER.

STEAMING SHORTLY

SIR,—With reference to the letter and photograph of the traction engine [Postbag, November 29] in which information is requested concerning it, I am able to give the following particulars.

The owner is Mr North, a farmer and transport contractor. The engine is a Wallis and Steevens, No 2338, date approximately 1895. It bears a road licence No HO 5806. The former owner was F. Coryton, of Greatham, near Liss, Hants.

It is in working order and may be steamed again shortly. I enclose a photograph which was sent to the MODEL ENGINEER a year or two ago.

Farnham, Surrey. E. C. GRIFFITHS.

RED AND GREEN

SIR,—In reply to Mr F. Davidson [Postbag, November 29] I should like him to take particular notice when next he comes up against road repairs and notice what happens when red and green are the only warnings. The time lag to clear the road for the opposite traffic is observed.

If this type of traffic control were in force at crossroads there would not be blockages or chaos.

Bristol 3. T. H. POLLARD.

WATER-GAUGE FITTING

SIR,—What on earth are we coming to?

I am referring to the article on the Allchin traction engine [MODEL ENGINEER, December 13] where the top fitting of the water-gauge is shown connected to a manifold where steam is taken off for injector and water-lifter.

L.B.S.C. pointed out this type of mistake years ago. In full-scale practice a slight leakage on the top water-gauge fitting will cause the level to rise, or vice versa on the

This traction engine on a Surrey farm is to be steamed shortly. See "Steaming shortly"

POSTBAG . . .

bottom. The steam pressure-gauge also should be connected direct to the steam space; the Factories Act says so.

Another point—will you ask your writers when mentioning stainless steel, of which there are many qualities, to specify which? In my profession I have found that S.80 or F.D.P. are safe in connection with boilers. Remember Austen-Walton's boilers?

I have been a reader of MODEL ENGINEER for 42 years.

Nottingham. FRANK BARRATT.

ELECTRICITY MYSTERIES

SIR,—I was interested to see Vulcan's note [Smoke Rings, November 22] on the effect produced by rubbing a television screen with a silk handkerchief. This is undoubtedly due to the action on the fluorescent coating of the tube of the static electricity generated by the rubbing action; the same effect can be brought about by rubbing a fluorescent lighting tube when switched off.

Furthermore, if a fluorescent tube is removed from its sockets and laid on a table in a darkened room it can be made to light up momentarily by vigorously rubbing a sheet of celluloid (preferably in one direction only) and quickly presenting it to the contacts at one end of the tube.

Readers may have noticed that a fluorescent tube will sometimes have difficulty in starting when first switched on, especially if the mains are a bit low; this trouble can generally be overcome if the tube is rubbed along its length with a silk handkerchief. Naturally, this wheeze won't be of any help to a spent or nearly expired tube!

Turning now to Mr Westbury's article on plastics, the Wearite Labpress is now made by an associate company of Messrs Wright and Weaire Ltd, namely Rendar Instruments Ltd, All Hallows Works, Park Lane, London, N.17. This particular press is supposed to give a pressure of eight tons; we have one in the works where I spend my days.

Tunbridge Wells, B. CHALMERS.
Kent.

SIR,—If I pass my fingers lightly over an electric kettle, a portable radio, an old vacuum cleaner, an electric toaster and an indoor TV aerial I can feel the vibrations Vulcan mentions. Except for the last I have tested the insulation which in all cases is better than ½ megohm.

What puzzles me is that a change-over of connections stops the effect. I can understand this with a radio, which may have a live chassis, but not with a properly earthed kettle.

I can also understand why a C.R. tube fluoresces in the vicinity of such a dynamic personality. You need an ion trap!

London, W.4. H. JOHNSTONE PRATT.

SIR,—I, too, have experienced the effect Vulcan mentions. It seems to be most noticeable with the aluminium housings of electro-magnetic apparatus operating on a.c. I have not noticed it on d.c.

It also happens with isolated apparatus, i.e., a magnetic solenoid fed by a double-wound transformer. I believe the effect is caused by currents circulating in the housings due to electro-magnetic induction, but I wouldn't be sure about this.

Letchworth, Herts. G. P. O'NEIL.

SIR,—The glass cathode tube has an inner layer on the surface which fluoresces under slight static discharge or electronic bombardment.

In a dry warm room, when the glass is rubbed by a silk handkerchief a frictional effect operates and generates a small static charge on the inner and outer surfaces of the glass. A small portion of this charge will leak away from the outer glass surface through to air but as the inside of the tube will be nearly a complete vacuum no simple leakage is possible with the inside charge and it will spread itself by diffusion along the inner coating. By doing so the first stage of equating its potential will be sufficient to excite a visible glow on the fluorescent material, usually salts of borium sulphide.

Birmingham. W. WARE.

SIR,—It is not imagination; I experience the same electrical impulses almost daily through the wooden cabinets of radio and TV sets I am servicing. But certain qualifying conditions must obtain:

1. The chassis must be a.c./d.c. or a.c. only but with one side of mains input connected to chassis.

2. In the case where an earth is used (only very rarely with modern TV sets) the connection is made through an isolating capacitor and therefore if the live side of the mains be connected to the chassis, even though the set be effectively earthed to RF, the chassis and the inside of the cabinet have a difference of potential to earth of the full main voltage and the very small leakage current can be detected.

3. This rarely occurs when the device is operated from a.c. mains with isolated mains input and chassis truly earthed.

4. When housed in a bakelite or other type of plastic cabinet the effect is much reduced and usually eliminated entirely.

The mystery of the glowing screen can also be explained. The clues in Vulcan's particular case are the silk handkerchief and the unprotected tube end face.

If a glass or Perspex rod is stroked with silk an electrostatic charge is induced in the rod and, being an insulator, it will retain this charge for a considerable time.

When Vulcan rubbed the end of the tube he created an electrostatic charge over the area of contact; this then served as one plate of a condenser, the other plate being the phosphor coating inside the tube face, the glass being the dielectric.

A movement of electrons then occurred in the phosphor under the influence of the charged area and manifested itself by glowing.

Some idea of the voltages created under these conditions is conveyed by the phenomenon which occurs when I clean Perspex filter screens. After withdrawing the screen from the TV cabinet I lay it face down on the bench to polish it. If the weather is cold and dry I sometimes have difficulty in separating the screen from the bench, and as I lift it away electrical discharges leap as much as six inches. The voltage gradient must be hundreds of kilovolts.

Weymouth, Dorset. W. FORD.

MR EAST'S "DUCHESS"

SIR,—As a helper at the Model Engineer Exhibition I had exceptional opportunities for examining and admiring Mr East's fine locomotive *Duchess of Buccleuch* with which he won the cup last year.

I feel sure that few of those who saw the engine could have guessed that she had been built with the very limited equipment which Mr East describes in his article. He is to be congratulated on producing not only a very fine engine but one which should serve as an inspiration and an encouragement to all who are working without elaborately equipped workshops.

North Wales. D. J. R. RICHARDS (Brigadier).

PICKLING BATH

SIR,—Reference to "Cleaning Brass" [Postbag, November 22] I am very interested in this suggestion. Does Mr Lambert use it instead of acid as a pickling bath after brazing?

If not, can he or anyone else say if it is possible to use it for this purpose as it would be much easier to use than dilute sulphuric acid?

Wilts. S. M. C. THEYER (Lt-Col).

DOING A REAL JOB

SIR,—The accompanying photograph (of special interest on account of Mr Maskelyne's article Locos I Have Known, November 29) shows an excellent Caledonian 4-4-0 miniature, which some time ago I found doing a real haulage job in a North Wales pleasure ground.

It is quite unusual for a model of this calibre to be working like this and I tried to find out something about the engine. But beyond the fact that it was reputed to have been shown at the Glasgow Exhibition of 1903, its whole early life seemed shrouded in mystery. The then owner had had it for only five years.

Does any reader know anything about it? Incidentally on a visit to the ground this last season the engine had gone.

Wirral. H. A. ROBINSON.

A miniature Caledonian 4-4-0 working a pleasure ground railway. See "Doing a real job"

HAIGH FOUNDRY

SIR,—I regret that I cannot accept the statements of Mr Hall and Mr Melling upon the subject of the Orrel engines [Postbag, December 20] as they are at variance with recognised facts, as the following will show. As Mr Hall resides at Wigan he can no doubt check the letters which I shall here mention.

From the diary of Simon Goodrich, engineer to the Navy Board under Sir Samuel Bentham from 1800 to 1814, we know from an entry therein that in the years 1810-12 at least a certain Robert Daglish was works manager of the Haigh Foundry. Daglish had been at Wigan from 1804 when he first took up an appointment as engineer to Lord Balcarres.

This appointment probably carried with it the management of the Haigh Foundry and also Brock Mill Forge. But according to Goodrich he was definitely manager of the former in 1812. Daglish in the year 1856, April 1, wrote two letters both of which, according to Dendy Marshall, are preserved in Wigan public library where doubtless Mr Hall can inspect them. I quote from one of these letters:

"I made the first [engine] in this country [Lancs] in 1812 and put it to work in 1813 nearly two years before Mr Stephenson made a locomotive engine in Northumberland."

The other letter contains a similar statement and adds that the Orrel Railway belonged to a Mr John Clarke. It is generally conceded, however, that the production of the normal type of locomotive at Haigh Foundry commenced in 1835, as Mr Hall stated in his first letter.

The foundry constructed for several lines, such as the Liverpool and Manchester, also Gt Western among others. Two unusual engines they built for the latter were the Snake and Viper, 1838, both having a geared drive.

The local tradition Mr Hall refers to is in fact correct as the name "Walking Horse" was bestowed upon the engines by no less a person that B. Hick of the Union Foundry in 1822, a copy of whose letter was reprinted in the *Wigan Examiner* for 3 May 1930.

Mr Hall is right off the rails in suggesting Kitsons as the builders, as James Kitson the founder of the firm was born in 1807 so at the time the Orrel engines were built he was only six years old.

I believe that locomotive work ceased at Haigh Foundry about 1856. In conclusion if Mr Hall cares for any other information about this concern I shall be pleased to let him have it.

Bishop's Stortford. G. WOODCOCK.

An original VANE GEAR . .

Concluded from page 69

small prong, *R*, and solder. Prong *R* slips into terminal *Q*. On my yacht, the weight was roughly six grams.

Clips E, E

Solder these on to base plate *B*, to hold assemblies *Y* and *Z* in place, allowing them to rotate freely on their pivots.

The vane, see Fig. 6

Make the vane out of $\frac{1}{16}$ in. balsa, with an aluminium tab at the bottom, for fixation on to the vane gear. Until I used a slip of aluminium my first vanes snapped off at the gear.

Cut the outline of the tab out of the lower end of the $\frac{1}{16}$ in. balsa, as shown. Then glue a reinforcing piece of 1/32 in. balsa on either side of the vane, with two more slips of 1/32 in. balsa shaped like the tab inside the opening in the $\frac{1}{16}$ in. sheet, leaving the central slit open. One way of preventing the glue from filling this slit is to insert the metal tab a few times while the assembly is drying.

In gluing the balsa wood of the vane no allowance is made for the 7/10 mm. thickness of the tab. This ensures a snug fit, and the springiness of the balsa will provide a firm grip on the aluminium.

The lower end of the tab is cut out to fit the vane post and is inserted in the slot of fitting *G*. Make sure the two points indicated by the arrows come right up against the base plate, *B*, in order to prevent fore and aft rocking.

To eliminate the self-tacking feature of the vane gear use a U-shaped aluminium clip which slips vertically over arms *F* and *H*, the baseplate *B*, and clamp, *C*; or drop a suitably-dimensioned bolt into the slots cut in arms *F* and *H*, near prong *Z*. [*]

ROUND THE TRADE

PRECISION MEASURING

A NEW RANGE of measuring instruments of Continental manufacture has been introduced by Production Promotion, 94 Camden Road, London, N.W.1. They include inexpensive micrometers of German make, three specimens of which, varying in price and quality, have been submitted for inspection.

Unlike some of the cheap micrometers now on the market, these are of all-steel construction and of a design in keeping with standard instruments; they have been tried out on practical work and found to be accurate and serviceable.

The micrometers examined all have a range of 0 to 1 in., and the cheapest, No 1, is graduated in thous and is fitted with a friction stop; Nos 2 and 3 have the more orthodox ratchet stop, also a locking device and a vernier reading to 10-thous and are supplied in a velvet-lined case complete with adjusting key. Fractional-decimal equivalents are marked on the bow of the No 3 specimen only.

Another interesting specimen examined is the 14 in. vernier height gauge, which is of Swedish manufacture. It has a stainless steel beam, with accurate and legible scale markings, and the vernier slide, reading to thous, is equipped with the orthodox fine adjustment screw and detachable scriber blade.

Provision is made for taking up wear of the slides and adjusting the zero position of the blade. This is supplied complete in polished hardwood case, at a price which is very moderate for such a high-class instrument. Other items of toolroom and inspection equipment are available from this firm.

BONDS' NEW BOILERS

SEVERAL types of small boilers suitable for marine and stationary models, also light industrial or laboratory work, have been introduced by Bonds o' Euston Road.

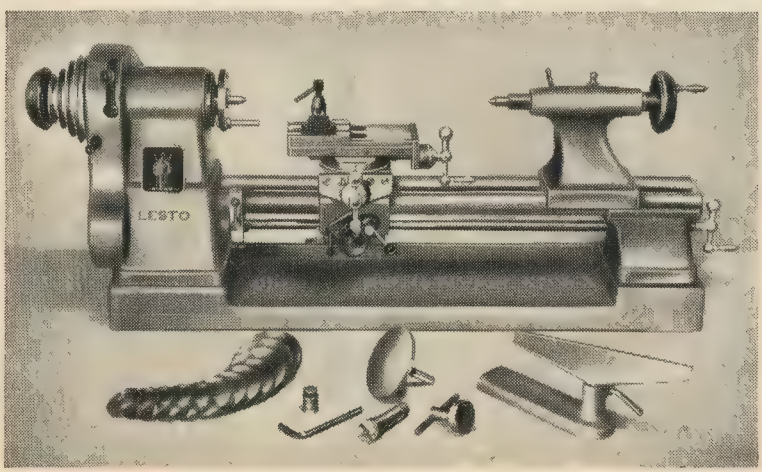
They include vertical steel boilers in various sizes, having either a single central flue or a number of vertical fire tubes. The boiler shells are rolled, with close-riveted and caulked seam, and the endplates, which are heavy pressings with deep flanges, are also riveted and caulked.

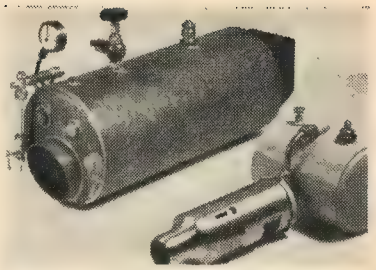
All materials and constructional specifications are in conformity with Board of Trade requirements, and the boilers are hydraulic tested to 120 p.s.i. Sizes available are as follow: 9 in. dia. × 18 in. high; 10 in. dia. × 20 in. high; 11½ in. dia. × 24 in. high; and 12 in. dia. × 30 in. high.

All have water-walled fireboxes, with grate and fire-door for solid-fuel firing, but are adaptable to either gas or oil firing.

A new horizontal internal-flue boiler in copper, to suit the larger sizes of model steamboats up to 5 ft or more in length, has also been introduced. This is 9 in. long × 3¾ in. o.d., and the flue tube is 1¾ in. dia., fitted with eight cross tubes ½ in. dia.

The Lesto lathe, which is of Swiss manufacture





Bonds' new internal-flue marine boiler and blowlamp

A torch type of paraffin blowlamp, employing a standard form of burner and flame tube, is used for firing, with a horizontal cylindrical container 3½ in. long × 2¾ in. dia., fitted with filler cap, release valve, and inflator valve to take a standard cycle pump connection.

This boiler is capable of steaming a ¾ in. × ¾ in. double-acting engine at full power output and speed, on 50 p.s.i. steam pressure, or larger engines at proportionately lower load and speed.

NEW UNIVERSAL LATHE

A SMALL bench lathe of interesting design, known as the Lesto, has been introduced into this country by Scintilla Ltd, 20 Carlisle Road, Hendon, London, N.W.9.

It is of Swiss manufacture and can be obtained in a simple "basic" form, for either wood or metal turning, or with additional equipment including compound slide-rest, screwcutting gear, and various attachments for milling, spherical turning, sawing, wood planing, and shearing.

The bed of the lathe consists of two cylindrical bars, one end of each being socketed in the headstock casting, while the other is bolted to accurately machined seatings in the foot casting. All sliding parts, including the tailstock, saddle, steadies and other attachments are machined to fit the bars.

The standard method of drive is by V-belt direct from motor, no countershaft being used; the four-step cone pulleys cover the normal speed requirements, but a reduction gear attachment having a ratio of 16 to 1 can be fitted to deal with heavy castings. A superspeed pulley is also available for use with the planing attachment, and a clutch unit can be incorporated in the motor pulley.

The maximum diameter of work which will swing over the bed is approximately 9 in., but woodwork of larger diameter can be turned on the outer end of the mandrel by using a special faceplate and toolrest. Two lengths of bed are available, giving capacity of slightly over 15 in. and 24 in. between centres respectively.

★ ★ ★ CLUB NEWS ★ ★ ★

Edited by THE CLUBMAN

FOR more than 70 years three steam engines made by James Watt and Co. of Birmingham have drained the western part of Hull, a city whose storm water used to be carried out by the tide. In all that period—from 1883 to the present—no serious breakdown has ever occurred at the West District Pumping Station although the engines sometimes run from 60 to 80 hours non-stop after heavy rain.

Hull is now to have a new pumping station with four units, each capable of as much work as all three Watt engines together. Live steamers will therefore be glad to know that the old engines are being treated by the city with a proper respect. Two of them will probably be kept as they are while the third is being presented to Birmingham Science and Industrial Museum.

Members of Hull S.M.E. were, of course, pleased with this news and doubly pleased to be welcomed on an evening visit to the old and new sites, through the good offices of Hull City Engineer.

A TRIBUTE

It is a tribute to the craftsmanship of the Soho Works in Birmingham, as well as to steam, that these engines should have given superb service throughout a human lifetime when the men who built them had none of the advantages conferred by modern tools. Secretary G. S. Shepherdson (25, Dryden Street, Westcott Street, Hull) tells me that their design is unique.

After viewing these engines—believed by some to be the last Watt Company engines in regular use—the party visited the very different scene at the adjoining site. The new Humberside Pumping Station, to be officially opened in the summer (though it may be working earlier), is reputed to have the largest capacity of any pumping station in Europe. From Mr Shepherdson's description it consists in essence of a huge cavity about 75 ft deep. At this level are the pumps. The electric motors for driving them stand on ground level together with a diesel-driven pump, power being transmitted through a worm-drive box. A central panel provides remote electric control for all the machinery.

The entire station is duplicated and room is provided for increased needs, with the provision of space in the layout for extra pumping equipment and of additional ducts fitted into culverts.

In addition, Hull Corporation Works Committee is giving the museum a Babcock and Wilcox steam boiler, which is described as one of the earliest water-tube boilers ever manufactured and is still used when needed after more than 62 years. But it is the pumping engine which live steamers will most want to see. To the schoolchildren of Hull it should be yet another reminder of how mediaeval their city and the other cities and towns of England still were in some aspects before the general introduction of steam power.

Gathering in the lower parts of Hull, the drainage water waited there until the tide swept it to a receiving well above the level of the Humber, the release gates being opened by men whose task it was to watch the sea.

NEW SPEED RECORDS

Two new speed records have been ratified by the Committee of the M.P.B.A. In Class A *Big Sparky* (G. Lines of Victoria) achieved a speed of 74.37 m.p.h. over a quarter mile, and in Class B *Nipper II* (M. de B. Daly of Blackheath) put up 66.66 m.p.h. over the same distance.

I also hear from J. H. Benson, the competition secretary and treasurer (25, St Johns Road, Sidcup, Kent), that Colonel H. J. Taplin of Birchington is generously offering an International trophy for a radio-control speed contest. It is hoped to run for the trophy next season.

Meanwhile secretary J. King (309, Days Lee, Sidcup) is asking for a full attendance at the annual general meeting of the M.P.B.A. on January 19. Clubs unable to send delegates should forward regatta dates and other matters for discussion to either Mr King or Mr Benson.

Regattas will be discussed at the meeting, and another subject on the agenda is finance. Radio control men are bound to be especially interested in the provisional rules for their speed events. The following are the six rules to be put forward by the committee for approval:

1. No steps or additional lifting surfaces allowed.
2. Officers in charge of an event to decide suitability of entry (as in Comp. Rule 4).
3. Boats not having engine control to be fitted with knock-off switch or device to limit length of run.
4. Sirgle or twin i.c. engines limited to 15 c.c. with a concession up to 30 c.c. for four or more cylinders.
5. Power-weight handicap of 1½ lb. per c.c. of cylinder capacity (ballast may be added if necessary).
6. Steam and electric craft: no power-weight restriction at present.

As a pleasant intermission from business, the record certificates will be presented. The venue is the Central Club at 127, Clerkenwell Road, London, E.C.1, and the meeting opens at 2.30 p.m.

M.E. DIARY

January 10.—Liverpool Nautical Research Society "Some Minor Mersey Ports," T. D. Tozer.

January 11.—Welling and District M. and E.E.S. "Ship Models." J.I.E. "Metal Bonding," Pepys House, 7 p.m. Malden and District S.M.E.E. annual meeting, Clubhouse, Thames Ditton, 7.45 p.m.

January 12.—Bristol S.M.E.E. annual dinner, Grand Hotel (tickets 12s. 6d.).

January 14.—Clyde Shiplovers' and Model Makers' Society "A Century of Burns-Laird Lines," Charles McCreary (illustrated), Kelvingrove Museum. J.I.E. Sheffield and District Section "Some Interesting Safety Devices," Sheffield, 7.30 p.m.

January 16.—Edinburgh S.M.E., The Secretary Entertains: The Titfield Thunderbolt, Simpson House, 7.30 p.m. Birmingham S.M.E. Talks by members, White Horse.

January 17.—Hull S.M.E. film show.

January 18.—Birmingham Ship Model Society, "Reminiscences," H. R. G. Whates.

Model Engineer

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Buck & Ryan for Lathes and Workshop Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661.

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Users of the "Atlas," "Sphere," "Halifax," "Acorntools" and "Little John," 5" s.s. and s.c. lathes will be pleased to know that all spare parts and a comprehensive range of additional equipment are available ex-stock—send for price lists. Spare parts also available for the "Atlas" and "Buffalo" (U.S.A.) drilling machines. —THE ACORN MACHINE TOOL CO. (1936) LTD., 610-614 Chiswick High Road, London, W.4. 'Phone: Chiswick 3416 (5 lines).

Spend 3s. 9d. and Get 6s. Value! Best carbon steel h/saw blades, 8", 3s. 9d. doz., 9", 4s. 6d. doz. Post free.—W. MOLDON, 364, King Street, London, W.6.

Malcar 4½" × 20" B.G.S.C. motorised bench lathe, three chucks, tools, etc., cost over £75, had little use, £45. Fobco "Star" ½" motorised drill, cost £39, as new, £27.—DOBSON, 8, Brandon Avenue, Thornley Park, Denton, Manchester.

Blower-Extractor Fan Units, with separate built-in compressor, fitted D.E. 220 volt d.c. motor, 2,900, £4 12s. 6d., carriage 11s. Edwards guillotine, 3' treadle, £30. No. 4 H.D., D.s. fly press, £25. Two No. 2 drilling heads, £7 each. Lorch 3" lathe, £25.—C. DUGARD LTD., Denmark Villas, Hove 32471.

Alum Alloy off-cuts in section sheet and rivets.—PRESTON, Heat House, Morley, Yorks.

3½" Screwcutting Lathe Dalton U.S.A., £25. Also Jones and Shipmans drilling machine, £17. Seen any time.—257, Shooters Hill Road, Blackheath, S.E.3.

Haighton Plain Lathe with accessories, £10, motorised, £13 o.n.o. or would exchange with cash adjustment for Myford. Collect London.—ROBERTS, Basement, 25, St. Stephens Gardens, W.2.

Vernier Calipers for Inside and Outside Measurements (including case). Readings metric or English, or both. Sizes, 6"-48" at prices unparalleled: example 20" gauge, £16. Price of other sizes on request. —Below.

Vernier Height Gauges (including case). Readings in metric or English or both. Sizes 10"-30". Price example: 12", £16 10s. Price of other sizes on request. Supplied by—ULTRATEK LTD., Victoria Works, Bingley, Yorks.

Wanted. ML7, Super 7, Boxford, or similar. Privately, cash. Can collect London area.—2, Isabella Road, Homerton, London, E.9.

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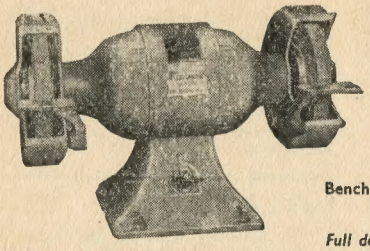

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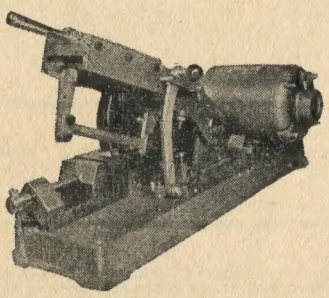

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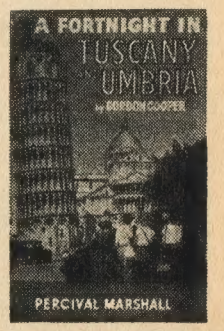

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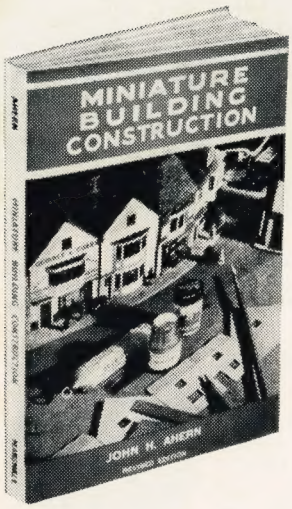

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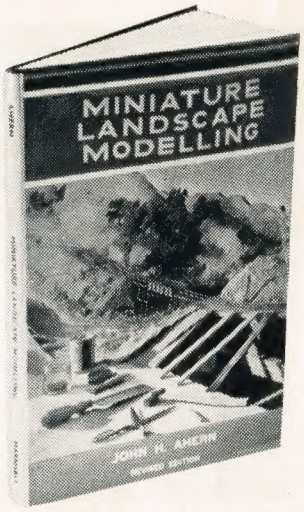

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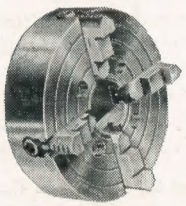

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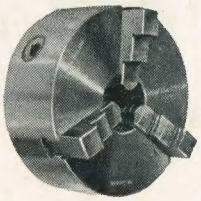

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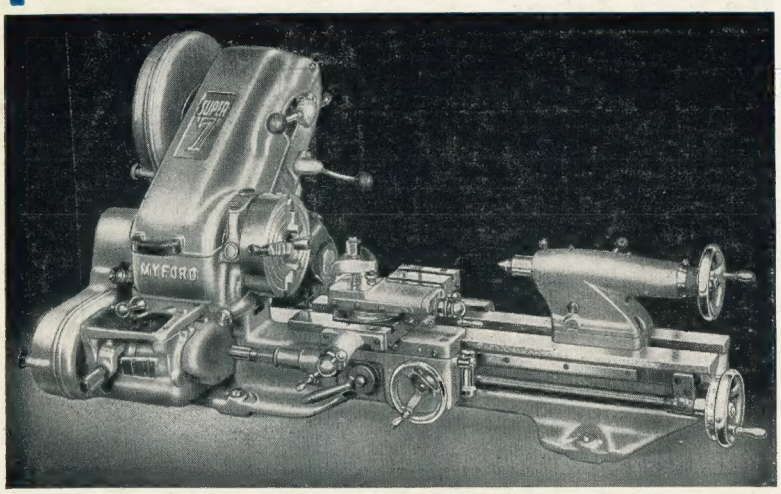

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